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NATIONAL DAM SAFETY PROGRAM. NEWMAN LAKE DAM (MO 30488), MISSIS--ETC(U)
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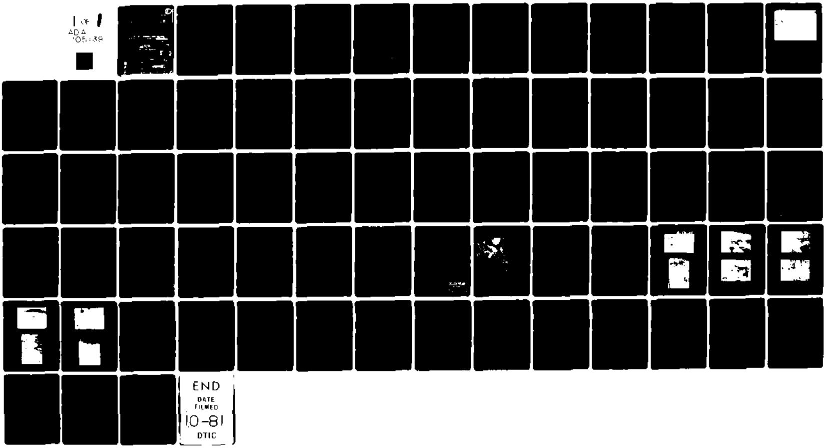

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MISSISSIPPI-KASKASKIA-ST. LOUIS BASIN

LEVEL II

NEWMAN LAKE DAM
MADISON COUNTY, MISSOURI
MO 30488

PHASE 1 INSPECTION REPORT
(6) NATIONAL DAM SAFETY [redacted]

Newman Lake Dam (MO 30488).
Mississippi - Kaskaskia - St. Louis Basin
Madison County, Missouri. Phase 1 Inspection
Report.

St. Louis District

(9) Final rept.,

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11 Apr 81

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

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REPORT DOCUMENTATION PAGE

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Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO
ATTENTION OF

SUBJECT: Newman Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Newman Lake Dam (MO 30488).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

a. Spillway will not pass 50 percent of the Probable Maximum Flood without overtopping the dam.

b. Overtopping of the dam could result in failure of the dam.

c. Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED — Chief, Engineering Division — 6 JUL 1981 Date

APPROVED BY: SIGNED — Colonel, CE, Commanding — 7 JUL 1981 Date

NEWMAN LAKE DAM

Madison County, Missouri

Missouri Inventory No. 30488

Phase I Inspection Report

National Dam Safety Program

Prepared by

Woodward-Clyde Consultants

Chicago, Illinois

Under Direction of

St Louis District, Corps of Engineers

for

Governor of Missouri

April 1981

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D. C., 20314. The purpose of a Phase I investigation is not to provide a complete evaluation of the safety of the structure nor to provide a guarantee on its future integrity. Rather the purpose of the program is to identify potentially hazardous conditions to the extent they can be identified by a visual examination. The assessment of the general condition of the dam is based upon available data (if any) and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed studies. In view of the limited nature of the Phase I studies no assurance can be given that all deficiencies have been identified.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with any data which may be available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action removes the normal load on the structure, as well as the reservoir head along with seepage pressures, and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, so that corrective action can be taken. Likewise continued care and maintenance are necessary to minimize the possibility of development of unsafe conditions.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam	Newman Lake Dam
State Located	Missouri
County Located	Madison
Stream	Unnamed Tributary of Snowden Branch Creek
Date of Inspection	25 February 1981

Newman Lake Dam, Missouri Inventory Number 30488, was inspected by Richard Berggreen (engineering geologist), Pierre Mallard (geotechnical engineer), Jean-Yves Perez (geotechnical engineer), and Sean Tseng (hydrologist).

The dam inspection was made following the guidelines presented in the "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed by the Chief of Engineers, US Army, Washington, DC, with the help of federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines represent a consensus of the engineering profession. These guidelines are intended to provide for an expeditious identification of those dams which may pose hazards to human life or property, based on available data and a visual inspection. In view of the limited scope of the study, no assurance can be given that all deficiencies have been identified.

Newman Lake dam is classified as a small earth dam, based on its height of approximately 25 ft and storage capacity of 140 ac-ft. The small dam classification criteria are: height between 25 and 40 ft, or storage capacity between 50 and 1000 ac-ft.

The St Louis District (SLD), Corps of Engineers, has classified this dam as having a high hazard potential. The SLD estimated damage zone length extends approximately 4 mi downstream. Within this estimated damage zone are several dwellings, a church, an electric transmission line, and a buried petroleum pipeline. The contents of the damage zone were verified by aerial reconnaissance.

Based on the findings of the visual inspection and analysis of other data, the dam appears to be in generally fair condition. No evidence was noted of disruption of the vertical or horizontal alignment of the dam crest, sinkhole development, cracking, slumping or animal burrows. The downstream slope is considered to be quite steep, on the order of 1.5(H) to 1(V) at the maximum section. Some wave erosion has occurred along the upstream slope. Trees growing on the downstream slope, some of which have been cut down, are considered a deficiency. Seepage and stability analyses for this dam comparable to the "Recommended Guidelines for Safety Inspection of Dams" are not on record, which is also considered a deficiency.

Hydraulic/hydrologic analyses of the dam and appurtenant structures indicate the dam will be overtopped by a flood greater than 22 percent of the Probable Maximum Flood (PMF). The PMF is defined as the flood event that may be expected to occur from the most severe combination of critical meteorologic and hydraulic conditions that are reasonably possible in the area. These analyses also indicate the dam will not be overtopped by the 1 percent probability-of-occurrence flood (100 year flood). No evidence or record of overtopping of the embankment was noted during the visual inspection.

On the basis of the distance to the nearest downstream hazard, nearly 2 mi, and the relatively small storage capacity of the reservoir, 140 ac-ft, 50 percent of the PMF is the recommended spillway design flood for this small size dam.

Based on our visual inspection of Newman Lake Dam and analysis of available information, the following recommendations should be addressed without undue delay.

1. Prepare a more detailed hydraulic/hydrologic analysis and design a spillway and discharge channel capable of passing the spillway design flood (50 percent PMF) without overtopping the embankment. The entire width of the spillway should be protected to prevent erosion.

2. An evaluation should be made of the impact of the trees growing on the embankment on the stability of the dam. This evaluation should include the trees which have been cut from the embankment. Removal of trees should be supervised by an engineer experienced in construction and maintenance of earth dams. Indiscriminate removal of trees could jeopardize the safety of the dam.

3. Seepage and stability analyses comparable to the requirement of the "Recommended Guidelines for Safety Inspection of Dams" should be performed.

4. Eroded areas, caused by wave-cutting on the upstream slope of the dam, should be repaired. Measures such as riprap or other erosion control may be required.

5. Evaluate the feasibility of a warning system to alert downstream residents in the event hazardous conditions develop at the dam during periods of heavy precipitation.

It is also recommended that a program of periodic inspections and maintenance be developed at this dam. This program should include, as a minimum, the measures listed below.

1. Inspect the embankment to identify evidence of cracking or slumping or other evidence of slope instability.

2. Inspect the areas of seepage at the toe of the embankment to identify changes in amount of seepage or turbidity in the seepage water.

3. Determine the condition and possible need for repair to the low-level outlet valve. Also prepare a program of regular inspection and maintenance for this valve.

4. Evaluate the feasibility of constructing a valve at the upstream end of the low-level outlet or plugging this conduit.

5. Clear the 14-in. culvert beneath the spillway. This is considered more of a convenience operation than a safety measure.

All inspections, remedial measures and maintenance should be performed by or under the guidance of an engineer experienced in the design, construction, and maintenance of earth dams.

WOODWARD-CLYDE CONSULTANTS

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Vice President

OVERVIEW
NEWMAN LAKE DAM

MISSOURI INVENTORY NUMBER 30488

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NEWMAN LAKE DAM, MISSOURI INVENTORY NO. 30488
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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NEWMAN LAKE DAM, MISSOURI INVENTORY NO. 30488

SECTION 1
PROJECT INFORMATION

1.1 General

a. **Authority.** The National Dam Inspection Act, Public Law 92-367, provides for a national inventory and inspection of dams throughout the United States. Pursuant to the above, an inspection was conducted of Newman Lake Dam, Missouri Inventory Number 30488.

b. **Purpose of investigation.** "The primary purpose of the Phase I investigation program is to identify expeditiously those dams which may pose hazards to human life or property... The Phase I investigation will develop an assessment of the general condition with respect to safety of the project based upon available data and a visual inspection, determine any need for emergency measures and conclude if additional studies, investigations and analyses are necessary and warranted" (Chapter 3, "Recommended Guidelines for Safety Inspection of Dams").

c. **Evaluation criteria.** The criteria used to evaluate the dam were established in the "Recommended Guidelines for Safety Inspection of Dams," and Engineering Regulation No. 1110-2-106 and Engineering Circular No. 1110-2-188, "Engineering and Design National Program for Inspection of Non-Federal Dams," prepared by the Office of Chief of Engineers, Department of Army; and "Hydrologic/Hydraulic Standards, Phase I Safety Inspection of Non-Federal Dams," prepared by the St Louis District (SLD), Corps of Engineers. These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 Description of Project

a. **Description of dam and appurtenances.** Newman Lake Dam is an earth dam approximately 269 ft long and 25 ft in height (Fig. 3A and 3B), impounding a lake used for recreational purposes. The downstream slope of the dam is steep, on the order of 1.5(H) to 1(V). The slope is covered with a dense growth of weeds, brush and trees to 18-in. in diameter.

The spillway for the dam is located at the right abutment (as the observer faces downstream). The spillway is trapezoidal in shape with a concrete lining in the center which functions as a weir during low flows. A 14-in. diameter culvert is located beneath the spillway crest with an invert elevation of about 853. The upstream end of the culvert was partially blocked, and water was at the elevation of the spillway crest at the time of the visual inspection. This culvert is apparently intended to control the lake level to minimize periods when water flows in the spillway which also serves as a road.

The discharge channel below the spillway is a broad, ill-defined, rock-lined channel ending in a waterfall. The rock in this channel is hard, unweathered, volcanic bedrock, and is not anticipated to be susceptible to significant erosion.

A low-level outlet is located near the toe of the maximum section. The outlet consists of a 6-in. diameter iron pipe with the control valve at the downstream end. The pipe was flowing approximately 20 gal/min at the time of the visual inspection.

b. **Location.** The dam is located in Martin Hollow on an unnamed tributary of Snowden Branch Creek, about 1/2 mile north of Highway A, between Cherokee Pass and Marquand in Madison County, Missouri (Fig. 1). The dam is in Section 2, T32N, R7E, on the USGS Marquand, Missouri 7.5-minute quadrangle map (1980).

c. **Size classification.** The dam is classified small based on its height of approximately 25 ft and storage capacity of 140 ac-ft. The small dam

classification criteria are: height between 25 and 40 ft, or storage capacity between 50 and 1000 ac-ft.

d. **Hazard classification.** The St Louis District (SLD), Corps of Engineers, has classified this dam as having a high hazard potential; we concur with this classification. The SLD estimated damage zone length extends approximately 4 mi downstream. Within this estimated hazard zone are several dwellings, a church, an electrical transmission line, and a buried petroleum pipeline. The contents of the downstream hazard zone were verified by aerial reconnaissance. The potential for loss of life and property is high in the event of sudden dam failure.

e. **Ownership.** The dam is reportedly owned by Mr Larry Laughlin, Route 2, Box 554, Marquand, Missouri 63655. Correspondence should be sent to his attention.

f. **Purpose of dam.** The reservoir impounded by the dam is used primarily for recreational purposes.

g. **Design and construction history.** Information on the design and construction of this dam was limited to interviews with Mrs Barbara Laughlin, wife of the present owner of the dam, and Mr Glen Newman, original owner of the dam.

Mrs Laughlin reported the dam was constructed in approximately 1957, but she had no plans or reports concerning design or construction. She referred us to Mr Newman who currently lives in Perry, Iowa.

Mr Newman recalled the dam was built by a construction firm from Lutesville, Missouri. He could not recall the name but was certain at least one of the owners was deceased. Mr Newman had no recollection of engineering or design documents, compaction tests or other reports. The embankment material was borrowed from the reservoir and discharge channel areas. The foundation was excavated to bedrock. His recollection was the upstream slope was built at 4(H) to 1(V) and the downstream slope at 2(H) to 1(V). He described the inlet structure for the low-level outlet as a 4-ft square, 3 to 4 ft high concrete block box with 3/8 to 1/2 in. mesh cover. He recalls an estimated 15,000 yd^3 of material was used in the embankment construction.

No other information was available on the dam construction.

h. **Normal operating procedures.** It was reported that the low-level outlet is opened to lower the lake level when flow begins over the spillway weir. No other facilities requiring operation were identified at this dam.

1.3 Pertinent Data

a. **Drainage area.** 0.86 mi^2

b. **Discharge at dam site.**

Maximum known flood at damsite	4 to 6 in. over spillway weir.
Warm water outlet at pool elevation	N/A (not applicable)
Diversion tunnel low pool outlet at pool elevation	N/A
Diversion tunnel outlet at pool elevation	N/A
Gated spillway capacity at pool elevation	N/A
Gated spillway capacity at maximum pool elevation	N/A
Ungated spillway capacity at maximum pool elevation	870 ft^3/sec
Total spillway capacity at maximum pool elevation	870 ft^3/sec

c. **Elevations (ft above MSL).**

Top of dam	858.4 to 859.1
Maximum pool - design surcharge	N/A
Full flood control pool	N/A
Recreation pool	855.0
Spillway crest (gated)	N/A
Upstream portal invert diversion tunnel	N/A
Downstream portal invert diversion tunnel	N/A
Streambed at centerline of dam	Unknown
Maximum tailwater	Unknown
Toe of dam at maximum section	833.5

d. **Reservoir.**

Length of maximum pool	1500 ft
Length of recreation pool	1400 ft
Length of flood control pool	N/A

e. **Storage (acre-feet).**

Recreation pool	94
Flood control pool	N/A
Design surcharge	N/A
Top of dam	140

f. **Reservoir surface (acres).**

Top of dam	16.2
Maximum pool	16.2
Flood control pool	N/A
Recreation pool	10.8
Spillway crest	10.8

g. **Dam.**

Type	Earth
Length	269 ft
Height	25 ft
Top width	13 to 20 ft
Side slopes	Downstream 1.5-2.8(H) to 1(V) Upstream, reported by former owner to be 4(H) to 1(V).
Zoning	Unknown, probably none.
Impervious core	Unknown, probably homogeneous.
Cutoff	Unknown.
Grout curtain	Unknown, probably none.

h. **Diversion and regulating tunnel.**

Type	None
Length	N/A
Closure	N/A
Access	N/A
Regulating facilities	N/A

i. **Spillway.**

Type	Partially concrete-lined weir at right abutment. 14-in. culvert beneath spillway, blocked at time of visual inspection.
Length of weir	Concrete-lined portion, 31 ft 83 ft at El 858.4 (minimum top of dam)
Crest elevation	855.0 ft
Gates	None
Downstream channel	Rock-lined channel ends at waterfall.

j. **Regulating outlets.** 6-in. iron pipe near maximum section of dam. Control consists of wrench operated gate valve at downstream end of pipe. Outlet flowing approximately 20 gal/min at time of visual inspection.

SECTION 2
ENGINEERING DATA

2.1 Design

Neither Mr Newman, the original owner of the dam, nor the current owners of the dam had any information on the design of the dam.

2.2 Construction

Mr Newman agreed with Mrs Laughlin's recollection that the dam was constructed in approximately 1957. He reported the dam was constructed by a firm from Lutesville, Missouri but could not recall the company's name.

The embankment was constructed of soil taken from the reservoir and discharge channel areas, according to Mr Newman. The foundation was excavated to bedrock, and the embankment slopes constructed at 4(H) to 1(V) on the upstream and 2(H) to 1(V) on the downstream slope. Mr Newman's recollection was 15,000 yd^3 of material were used in the construction.

No other information was available on the dam construction.

2.3 Operation

Mrs Laughlin reported the low-level outlet is opened to lower the lake level when water begins to flow over the spillway weir. The wrench necessary to open the valve was not available during the visual inspection and the valve was not operated by the inspection team. The outlet was flowing approximately 20 gal/min. This could be due to either a damaged valve or incomplete closure after the last use.

2.4 Evaluation

a. **Availability.** Information on the design and construction of Newman Lake Dam was limited to interviews with Mr Glen Newman, the original owner.

b. **Adequacy.** The available engineering data and information are insufficient to evaluate the design of this dam. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" are not on record. This is a deficiency which should be rectified. These analyses should be performed for appropriate loading conditions, including earthquake loads, and made a matter of record. These analyses should be performed by an engineer experienced in the design and construction of earth dams.

c. **Validity.** The information obtained from Mr Newman generally agrees with the findings of the visual inspection. However, the information is incomplete.

2.5 Project Geology

The dam is located on the southeast flank of the Ozark structural dome. The regional dip is toward the southeast, but local variations occur in the vicinity of exposed and buried Precambrian bedrock knobs. The bedrock in the area is mapped as Precambrian age St Francois Mountains Volcanic Supergroup (Fig. 4), consisting of rhyolite and felsite volcanic rock. This rock outcrops at the toe of the dam, near the toe of the left abutment, and in the discharge channel below the spillway. It appears very hard and unweathered.

Cambrian age sedimentary rocks of the Elvins Group and Bonneterre Formation are also mapped in this area (Fig. 4), but were not found outcropping at the dam site.

The soil at the damsite consists of gravelly to sandy silty clay (CL) and clayey silt (ML). The material was sampled and classified in the field. This was the soil used in the dam construction. The erosion potential of this soil was judged moderate to high in the embankment primarily on the basis of the relatively steep slopes and anticipated flow velocities in the event of overtopping. The soil is mapped on the General Soils Map of Missouri (1979) as Peridge-Cantwell-Gasconade Soil Association.

Several faults are mapped in the vicinity of the dam site. The Grenville Fault, located about 9 mi south of the dam, is a northeast-southwest trending fault approximately 38 mi long. The fault is mapped as northwest side up.

A branch of the Simms Mountain Fault System is mapped approximately 8 mi northeast of the dam. This system is a complexly branching series of faults about 40 mi in length, trending northwest-southeast. Displacement on the fault system is mapped as southwest side up.

These faults, like most others in the Ozark region, occur in Precambrian and Paleozoic bedrock and are likely Paleozoic in age. The area is not seismically active and these faults are not considered to pose an unusual hazard to the dam.

The dam is located approximately 70 mi northwest of the line of epicenters for the very large New Madrid earthquakes of 1811 and 1812. A recurrence of an earthquake of the magnitude of the New Madrid events could cause damage to the dam, but an evaluation of this risk is beyond the scope of this Phase I investigation.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. **General.** A visual inspection was made of Newman Lake Dam on 25 February 1981. Mrs Barbara Laughlin, wife of the owner of the dam, accompanied the inspection team on the inspection. The inspection indicated the dam was in generally fair condition.

b. **Dam.** The dam is an earth embankment constructed of locally-obtained gravelly to sandy silty clay and clayey silt soil. The soil appears to be a residual soil developed by weathering of the bedrock in the area. The gravel fraction consists of unweathered volcanic bedrock, generally small gravel size.

The downstream slope of the embankment is typically steep, on the order of 1.5(H) to 1(V) at the maximum section (Fig. 3B). Large trees, to 18-in. diameter, are growing on and at the toe of the dam (Photo 1). Several trees have been cut down and only stumps remain. The root systems for these trees, particularly the trees which have been cut, could provide piping paths through the dam. The owners were informed by others before the inspection visit that indiscriminate cutting of trees could jeopardize the dam's safety and have discontinued this practice.

The downstream slope is also vegetated with weeds and brush. This vegetative cover probably offers moderate erosion protection in the event of overtopping. However, the vegetation may also hamper identification of evidence of slope instability.

No evidence was noted of significant erosion on the downstream face or at the junction of the embankment and abutments. No evidence was noted of cracking, slumping, sinkhole development, animal burrows or detrimental settlement. No disruption of the vertical or horizontal alignment of the crest of the dam was noted during the visual inspection. No evidence or record of overtopping was noted during the inspection.

No riprap or other erosion protection was present on the upstream slope of the dam. Wave erosion has cut a vertical notch perhaps 2 ft high at the high water line (Photo 2). Dense vegetation on the upstream slope offers some erosion protection, but erosion will likely continue in this area. At present the crest of the dam is approximately 13 to 20 ft wide, and is crossed by a gravel road (Photo 3) which provides access to residences on the north side of the reservoir.

The dam appears to have been constructed on a foundation of hard, unweathered volcanic bedrock. This rock outcrops in the discharge channel below the spillway and along much of the toe of the dam (Photo 4).

Seepage was noted along the toe of the dam at the left abutment (Photo 5) and near the maximum section (Photo 6). The soil in this area is spongy. Seepage at the surface was estimated at approximately 2 to 4 gal/min. This seepage could be occurring either at the contact of the bedrock and embankment or through joints in the bedrock. It did not appear to be seeping from within the embankment. The seepage water was not carrying any soil, and did not appear to pose an unusual hazard to the dam at the time of the visual inspection.

c. **Appurtenant structures.**

1. Spillway. The spillway consists of a partially paved concrete swale (Photo 7 and Fig. 3A), roughly trapezoidal in shape, at the right abutment (as the observer faces downstream). The gravel roadway along the dam crest crosses the spillway. A 14-in. culvert passes beneath the spillway, but was partially blocked at the upstream end at the time of the visual inspection and was assumed inoperative for the overtopping analysis. For low flows the concrete lining should prevent erosion of the spillway. However, for significant flood flows the depth of flow may exceed the depth of the concrete-lined portion and erosion of the unlined portion of the spillway could occur.

At the time of the visual inspection water was just beginning to flow onto the paved portion of the spillway, but had not begun flowing across the entire spillway weir. Flow through the partially blocked 14-in. culvert was estimated at perhaps 10 to 20 gal/min.

The owner reported that the roadway crossing the spillway had been covered to a depth of approximately 4-6 in. during peak flood runoff. An alternate access to the residences on the north side of the dam and reservoir is available via a road around the upstream end of the reservoir.

2. Low-level outlet. A low-level outlet structure was identified near the toe of the maximum section. The outlet consists of a 6-in. diameter iron pipe with a wrench-operated gate valve at the downstream end (Photo 8). The wrench was not available to the inspection team and the outlet could not be operated during the visual inspection visit. It was reported that the outlet is opened when flow begins to pass over the spillway weir. The pipe was flowing an estimated 20 gal/min at the time of the inspection visit. It could not be determined if this was due to damage to the valve or not closing the valve completely after the last use.

It should be noted that it is not good engineering practice to have the control at the downstream end of the outlet. This allows the pipe under the dam to have a full reservoir head within the pipe. If a leak develops in the pipe under the dam, the pressure could produce piping and internal erosion of the embankment.

In view of the fact that the valve control wrench is not immediately available at the dam in the event of an emergency and the capacity of the pipe is small relative to the spillway capacity, this outlet facility was considered inoperative during the overtopping analysis.

d. **Reservoir area.** The slopes surrounding the reservoir are relatively flat, on the order of 5(H) to 1(V) or flatter. The area around the reservoir is sparsely developed with permanent and vacation homes, but consists mostly of woodlands and pasture. No records are available of sedimentation in the reservoir. The lack of logging or agricultural development in the drainage basin upstream of the reservoir indicates siltation will not significantly impact the reservoir.

e. **Downstream channel.** The downstream channel below the spillway flows across an area of exposed bedrock (Photo 9). The channel is ill-defined and extends from the spillway to a rock waterfall (Photo 10) beyond the toe of the dam.

Erosion of the channel is unlikely due to the very hard bedrock which comprises the channel and waterfall. Some tree stumps and brush debris have apparently been dumped in this area and could pose an obstruction to flood flows.

3.2 Evaluation

The visual inspection indicated the dam is in generally fair condition. The downstream slope is quite steep, on the order of 1.5(H) to 1(V) at the maximum section. Large trees are growing on the embankment, and several have been cut down. The root systems for these trees could provide piping paths through the embankment. Seepage and spongy ground were noted at the toe of the dam, but the seepage water did not appear to be carrying any soil. No erosion protection is present on the upstream slope and wave erosion has cut a notch approximately 2 ft high at the high water line.

No erosion at the abutments, cracking, slumping, animal burrows, sinkhole development, or disruption of the vertical or horizontal alignment of the dam crest was noted during the visual inspection. It should be noted that visual inspection of the dam was hampered by the heavy vegetative cover.

Erosion is likely in the unlined portion of the spillway during periods of heavy flows. The embankment soils are considered moderately erodible in the event of overtopping of the dam.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

The only operating facility identified at this dam was the low-level outlet near the toe of the maximum section. It was reported that this outlet is opened to lower the lake level when water begins to flow over the spillway weir.

It should be noted that it is not good engineering practice to have the control valve located at the downstream end of the outlet facility. This configuration results in the pipe beneath the dam being at full reservoir pressure. If a leak develops in the pipe, this pressure could cause internal erosion of the embankment.

4.2 Maintenance of the Dam.

Trees have been cut on the downstream embankment slope. The owners were informed by others prior to the visual inspection that the removal of trees should be done under the guidance of an engineer experienced in the maintenance of dams. Indiscriminate removal of trees could jeopardize the safety of the dam. This practice has apparently been discontinued.

No apparent maintenance has been performed on the upstream slope of the dam. Wave erosion has cut a near-vertical notch approximately 2 ft high near the high water line. Vegetation in this area provides some protection but erosion will likely continue in this area unless riprap or other remedial measures are implemented.

4.3 Maintenance of Operating Facilities

No records were available for maintenance of the low-level outlet at this dam. No other operating facilities were identified.

4.4 Description of Any Warning System in Effect

No warning system was identified in the visual inspection of this dam.

4.5 Evaluation

There is apparently no formal maintenance program in effect for this dam. It is recommended that erosion control and remedial measures be performed on the upstream slope of the dam. An evaluation should be made of the operability of the low-level outlet and any necessary maintenance. An evaluation should be made of the need to remove trees and possibly the heavy brush from the dam embankment. Removal of trees should be done under the guidance of an engineer experienced in the maintenance of earth dams. Indiscriminate removal of trees could jeopardize the safety of the dam. An evaluation should be made of the feasibility of a practical and effective warning system to alert downstream residents in the event hazardous conditions develop at this dam.

SECTION 5
HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design data. No hydrologic or hydraulic design data were available for evaluation of this dam or reservoir; however, dimensions of the dam were surveyed. The survey data were supplied by James McCaul III and Associates of Potosi, Missouri. Other relevant data were measured during the field inspection or estimated from topographic mapping. The maps used in the analyses were the USGS Cherokee Pass (1980) and Marquand (1980), Missouri 7.5-minute quadrangle maps.

b. Experience data. No recorded rainfall, runoff, discharge, or pool stage historical data were found for this reservoir. The maximum known flood was reported to result in flow 4 to 6 in. deep over the spillway weir. There was no record that the embankment had ever been overtopped.

c. Visual inspection.

1. Watershed. The watershed is sparsely developed and consists primarily of woodlands and pasture. The reservoir area is about 2 percent of the total watershed area of 0.86 mi^2.

2. Reservoir. The reservoir and dam are best described in Section 3 of this report and by the maps and photographs enclosed herewith.

3. Spillway. The spillway is located at the right (south) end of the dam. The spillway crest is partially paved. The paved area can accommodate normal low flows but will not accommodate the recommended spillway design flood of 50 percent PMF. A 14-in. diameter culvert beneath the spillway was partially blocked at the upstream end.

4. Seepage. The magnitude of seepage through the dam and water flowing through the two conduits was not considered significant to the overtopping potential.

d. **Overtopping potential.** One of the primary considerations in the evaluation of Newman Lake Dam is the assessment of the potential for overtopping and consequent failure by erosion of the dam. The lowest portion of the dam crest (858.4 ft) considered to be the top of the dam for determining overtopping potential is near the center of the dam at the maximum section.

Hydrologic analysis of this dam for the 1 and 10 percent probability-of-occurrence floods and Probable Maximum Flood (PMF) were all based on initial water surface elevations equal to the lowest elevation on the spillway crest (855.0 ft). The results of the analyses indicate that the dam will be overtopped by a flood greater than 22 percent of the PMF. The PMF is defined as the flood event that may be expected to occur from the most severe combination of critical meteorologic or hydrologic conditions that are reasonably possible in the region. The analyses also indicate that the spillway will pass the 1 percent probability-of-occurrence (100-year) flood event without overtopping the dam. The 1 percent probability-of-occurrence flood event is the flood event that has a 1 percent chance of occurring in any year, or occurs on the average once every 100 years.

The following overtopping data for various flood events were computed assuming no erosion of the spillway or embankment.

Precipitation Event	Maximum Reservoir W.S. Elevation, ft (MSL)	Maximum Depth Over Dam, ft	Maximum Outflow, ft^3/sec	Duration of Overtopping, Hrs
1% Prob	858.3	0	840	0
22% PMF	858.4	0	860	0
50% PMF	859.4	1.0	2100	3.5
100% PMF	860.4	2.0	4200	6.0

On the basis of the distance to the nearest downstream hazards, nearly 2 mi, and the relatively small reservoir storage volume, 140 ac-ft, it is recommended that 50 percent of the PMF be used as the spillway design flood.

It should be noted that at 50 percent of PMF, the present configuration of the spillway and dam crest will result in a depth of overtopping of 1 ft and the dam may be overtopped for 3.5 hours. This depth and duration of overtopping is considered likely to result in sufficient erosion to produce an effective breach of the dam. At the maximum pool elevation of 858.4 ft, the velocity of flow in the spillway may reach 8.3 ft/sec. This velocity could erode the unpaved portions of the spillway.

Input data and output summaries for the hydrologic and hydraulic analyses are presented in the attached Appendix B.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual observations. The visual inspection of the dam indicated the dam is in generally fair condition. There was no evidence noted of lateral spreading or settlement of the dam crest. No evidence was noted of sinkhole development on the dam or in the area surrounding the dam site. No cracking, slumping or animal burrows were noted. However, the downstream slope ~~appeared~~ quite steep, on the order of 1.5(H) to 1(V) at the maximum section.

The vegetation on the dam included large trees to 18-in. in diameter. These trees are considered a deficiency in that if the trees die or are cut down, the decay of the root systems could provide piping paths through the embankment. Stumps were noted where some trees had been cut down. The owner informed the inspection team that they had discontinued this practice after being told that indiscriminate removal of trees could jeopardize the safety of the dam.

Seepage was noted at the toe of the dam near the maximum section and at the left abutment. The seepage near the maximum section appeared to be occurring at or near the contact between the embankment and bedrock. At the left abutment, the soil near the toe of the slope was quite spongy, suggesting the ground is saturated. This area should be inspected periodically to identify potential slope stability problems. The seepage water did not appear to be transporting any soil and did not appear to pose an unusual hazard to the dam at the time of the visual inspection.

b. Design and construction data. No design or construction records were available for this dam. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available. This is considered a deficiency which should be rectified.

c. Operating records. No operating records or water level records are maintained for this dam and reservoir.

d. Post construction changes. No post construction changes were identified at this dam other than the growth of trees and brush on the upstream and downstream slopes of the embankment.

e. Seismic stability. The dam is located in Seismic Zone 2 to which the guidelines assign a moderate damage potential. During a seismic event, liquefaction of the gravelly, silty clay dam material is unlikely. However, without knowledge of the soil properties of the embankment materials, the seismic stability of the dam cannot be evaluated.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. **Safety.** Based on the findings of the visual inspection and analysis of other data, the dam appears to be in generally fair condition. No evidence was noted of disruption of the vertical or horizontal alignment of the dam crest, sinkhole development, cracking, slumping, or animal burrows. Some wave erosion has occurred along the upstream slope. The trees which are growing on the downstream slope are considered a deficiency. An evaluation of the impact on the stability of the dam of the trees which have been cut down is recommended. The seepage at the toe of the dam did not appear to pose an unusual hazard at present, but should be periodically inspected to identify any changes in conditions. The heavy brush growing on the downstream slope of the dam should be controlled to facilitate visual inspection. Hydraulic/hydrologic analyses of the dam and appurtenant structures indicate the dam will be overtopped by a flood greater than 22 percent of the Probable Maximum Flood (PMF). On the basis of the distance to the nearest downstream hazard, nearly 2 mi, and the relatively small storage capacity of the reservoir, 140 ac-ft, 50 percent of the PMF is the recommended spillway design flood.

Seepage and stability analyses for this dam comparable to the recommended guidelines are not on record, which is considered a deficiency that should be rectified.

b. **Adequacy of information.** The visual inspection provided sufficient information to support the recommendations presented in this Phase I report. The lack of design documents such as static and seismic stability analyses and seepage analysis precludes an evaluation of the stability of the dam. This is considered a deficiency which should be corrected.

c. **Urgency.** The deficiencies described in this report could affect the safety of the dam. Remedial measures presented in Sections 7.2b and 7.2c should be addressed without undue delay in order to prevent development of hazardous conditions at this dam.

d. **Necessity for Phase II.** In accordance with the "Recommended Guidelines for Safety Inspection of Dams," the subject investigation was a minimum study. This study revealed that additional in-depth investigations are needed to complete the assessment of the safety of the dam. Those investigations which should be performed without undue delay are described in Section 7.2b. It is our understanding from discussions with the SLD that any additional investigations are the responsibility of the owner.

7.2 Remedial Measures

a. **Alternatives.** There are several general options which may be considered to reduce the possibility of dam failure or to diminish the harmful consequences of such a failure. Some of these options are described below.

1. Remove the dam, or breach it to prevent storage of water.

2. Increase the height of dam and/or spillway size to pass the spillway design flood (50 percent of PMF) without overtopping the dam.

3. Purchase downstream land that would be adversely impacted by dam failure, and restrict human occupancy.

4. Provide a highly reliable flood warning system (generally does not prevent damage but diminishes chances for loss of life).

b. **Recommendations.** Based on our inspection of Newman Lake Dam, it is recommended that the following remedial measures and studies be addressed without undue delay.

1. Prepare a more detailed hydraulic/hydrologic analysis and design a spillway and discharge channel capable of passing the spillway design flood (50 percent of PMF) without overtopping the embankment. The entire spillway should be protected to prevent erosion.

2. An evaluation should be made of the impact of the trees growing on the embankment on the stability of the dam. This evaluation should include the

trees which have been cut from the embankment. Removal of trees should be performed by an engineer experienced in construction and maintenance of earth dams. Indiscriminate removal of trees could jeopardize the safety of the dam.

3. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" should be performed.

4. Eroded areas, caused by wave-cutting on the upstream slope of the dam, should be repaired. Measures, such as riprap or other erosion controls, may be required.

5. Evaluate the feasibility of a warning system to alert downstream residents in the event hazardous conditions develop at the dam during periods of heavy precipitation.

c. O & M procedures. It is recommended that a program of periodic inspections and maintenance be developed at this dam. This program should, as a minimum, include the following measures.

1. Control the heavy brush growing on the downstream slope to facilitate periodic inspections.

2. Inspect the embankment to identify evidence of cracking or slumping or other evidence of slope instability.

3. Inspect the embankment for seepage at the toe to identify changes in amount of seepage or turbidity in the seepage water.

4. Determine the condition and possible need for repair to the low-level outlet valve. Prepare a program of regular inspection and maintenance for this valve.

5. Evaluate the feasibility of constructing a valve at the upstream end of the low-level outlet, or plugging this conduit.

6. Clear the 14-in. culvert beneath the spillway. However, this is more of a convenience operation than a safety measure.

All inspections, remedial measures and maintenance should be performed by or under the guidance of an engineer experienced in the design, construction, and maintenance of earth dams.

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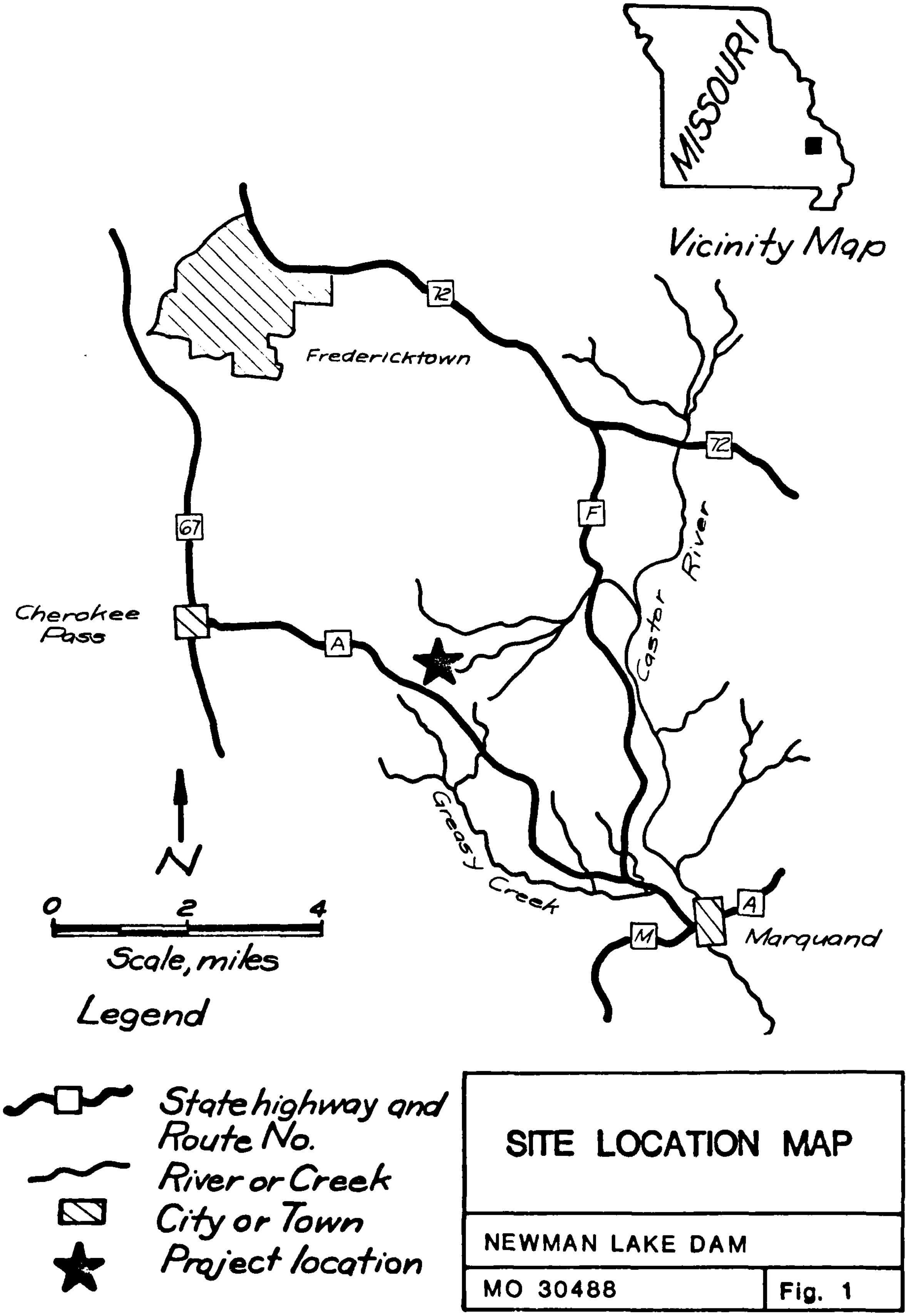
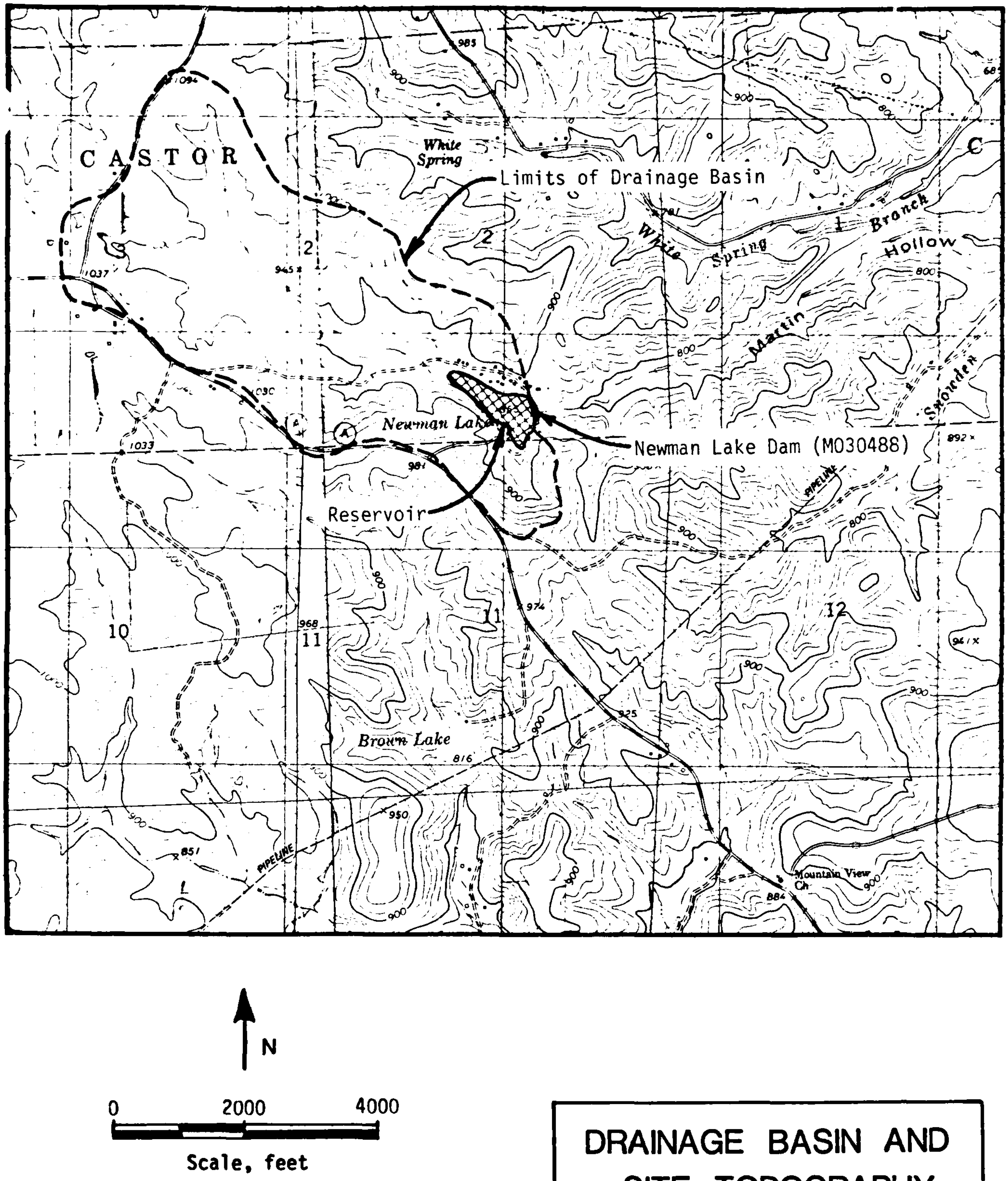


SITE LOCATION MAP

NEWMAN LAKE DAM

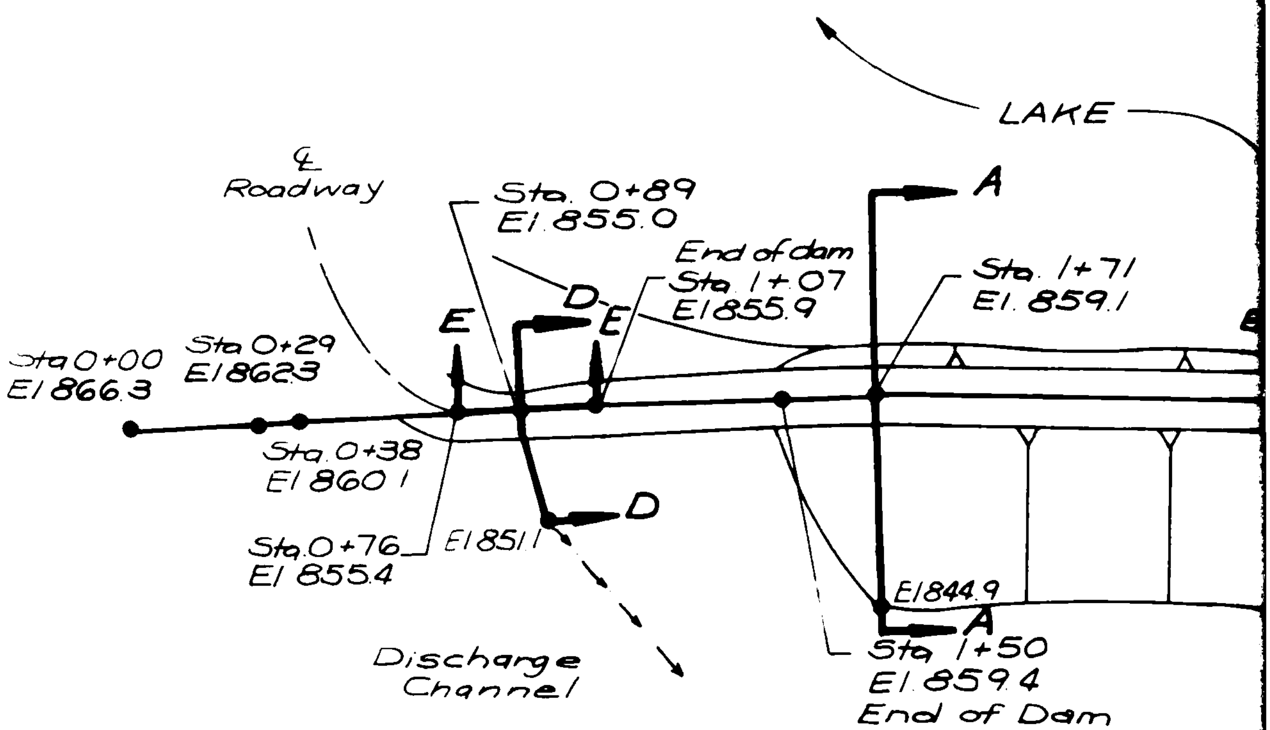
MO 30488

Fig. 1

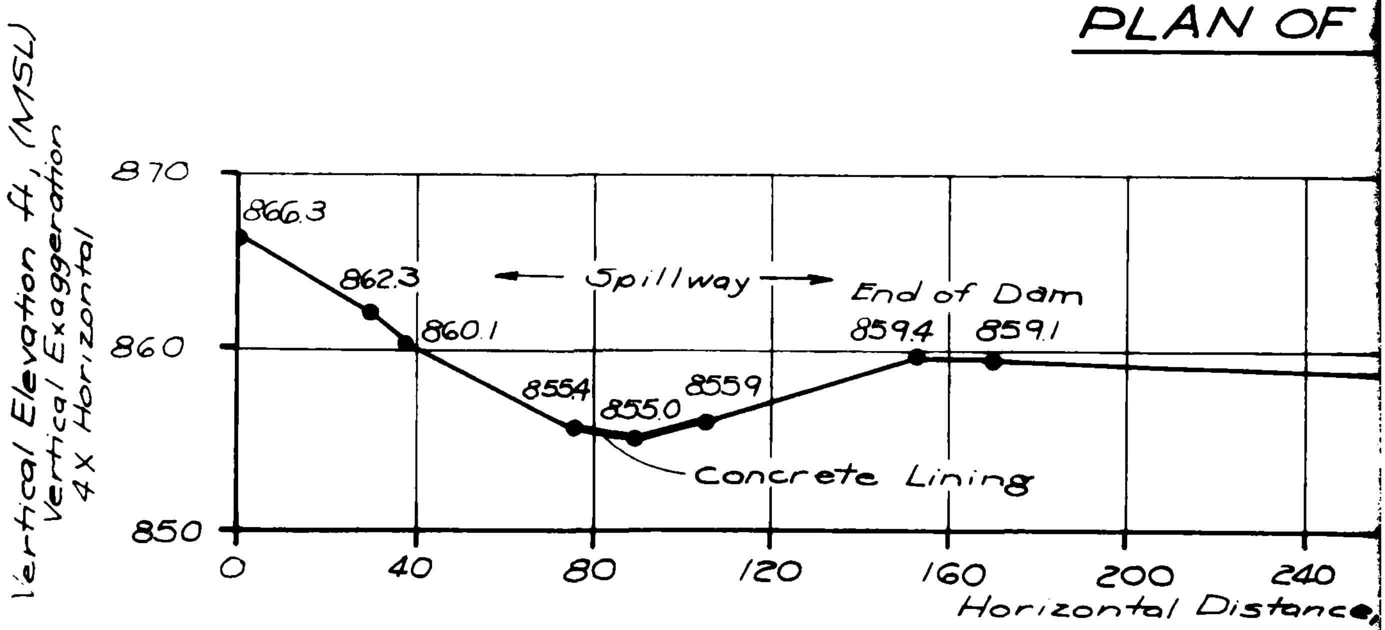


Note: Topography from USGS Marquand (1980) and Cherokee Pass (1980) 7.5-minute quadrangle maps.

DRAINAGE BASIN AND SITE TOPOGRAPHY	
NEWMAN LAKE DAM	
MO 30488	Fig. 2



PLAN OF



PROFILE OF DA

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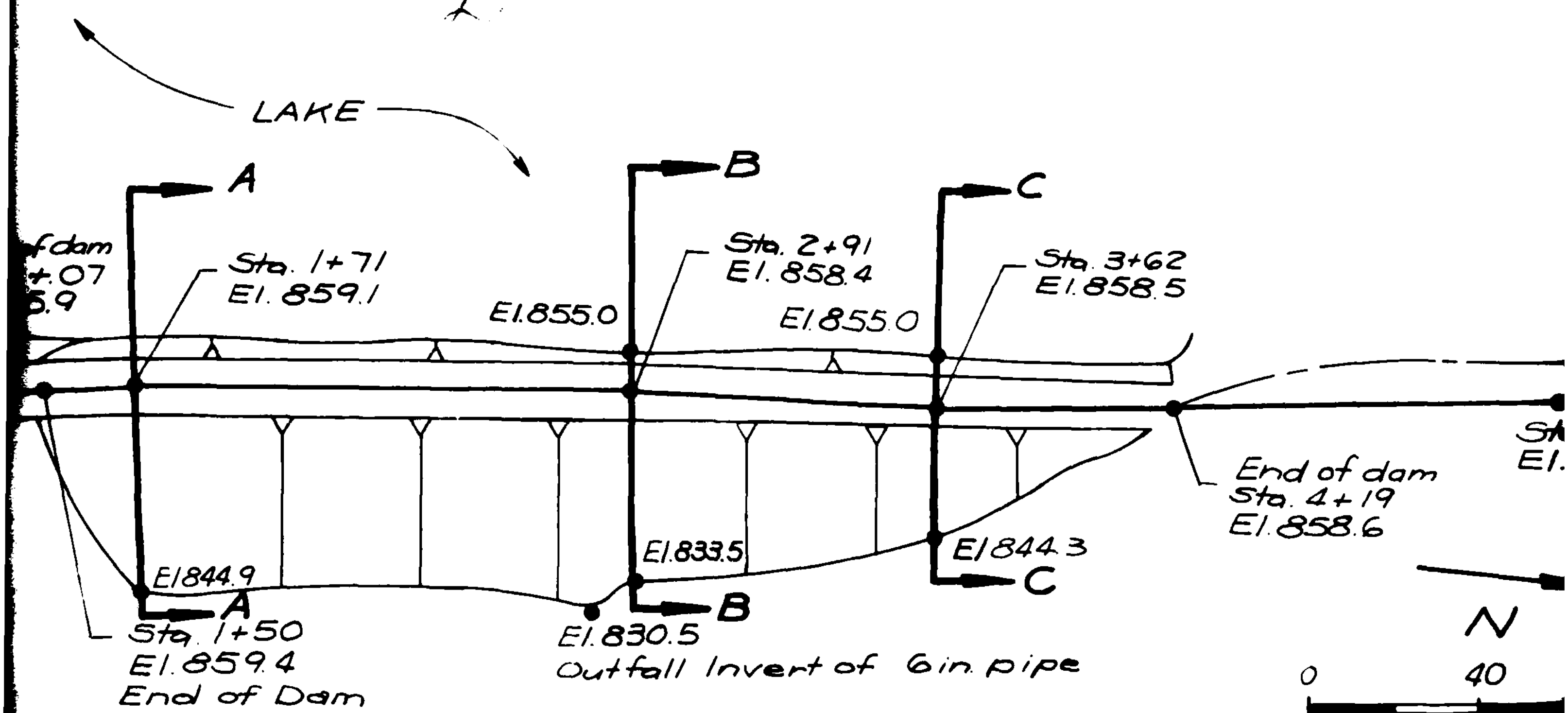
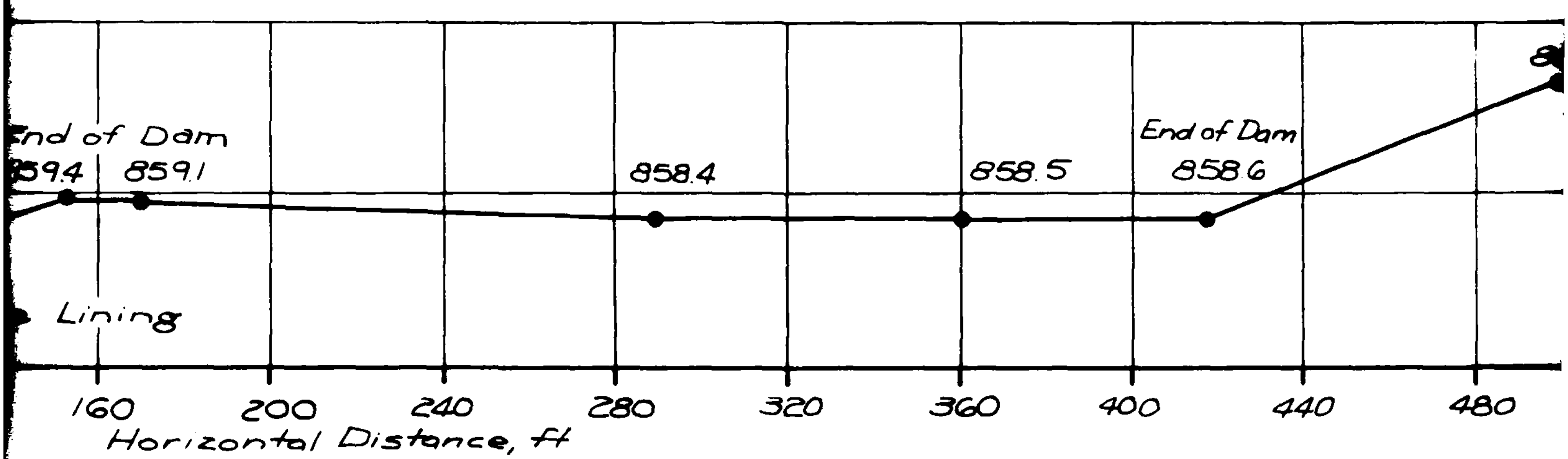


PLAN OF DAM



PROFILE OF DAM

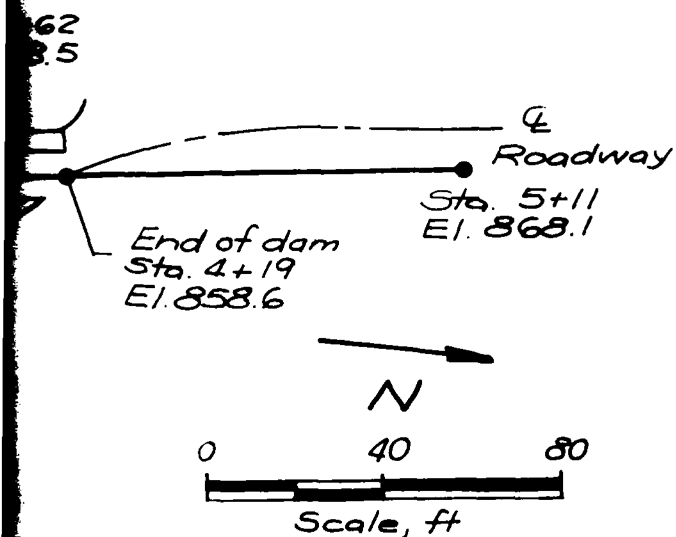
NOTE:
Surveyed 17 March 1981 by
James F. McCaul III and
Associates, Consulting
Engineers/Land Surveyors,
Potosi, Missouri

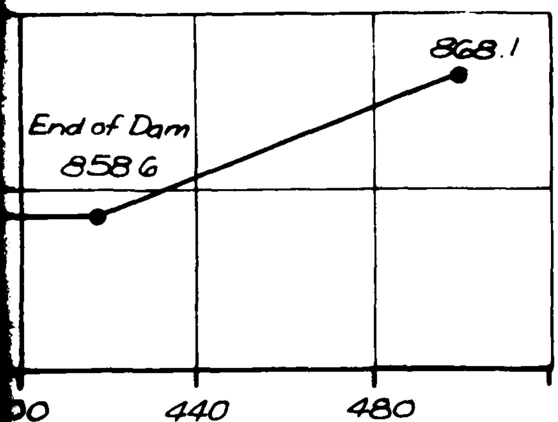
DAM
PLAN AND

NEWMAN LAKE

MO 30488

3





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DAM PLAN AND PROFILE	
NEWMAN LAKE DAM	
MO 30488	Fig. 3-A

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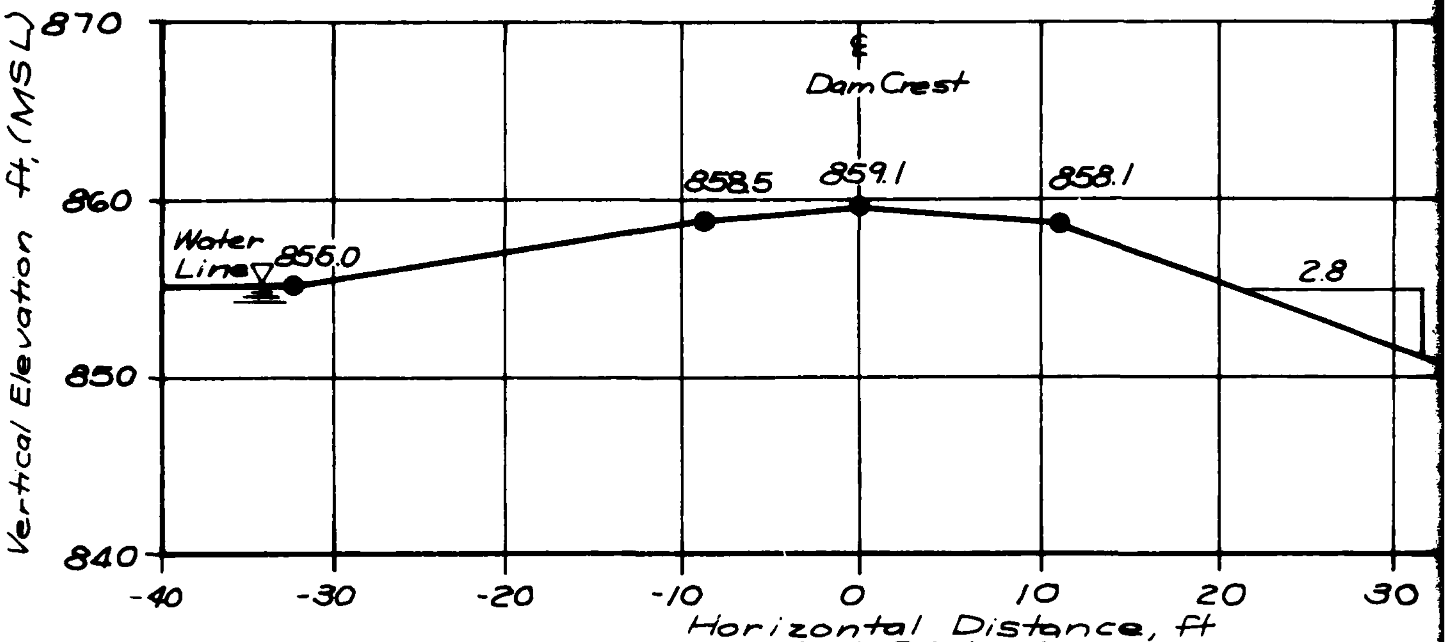
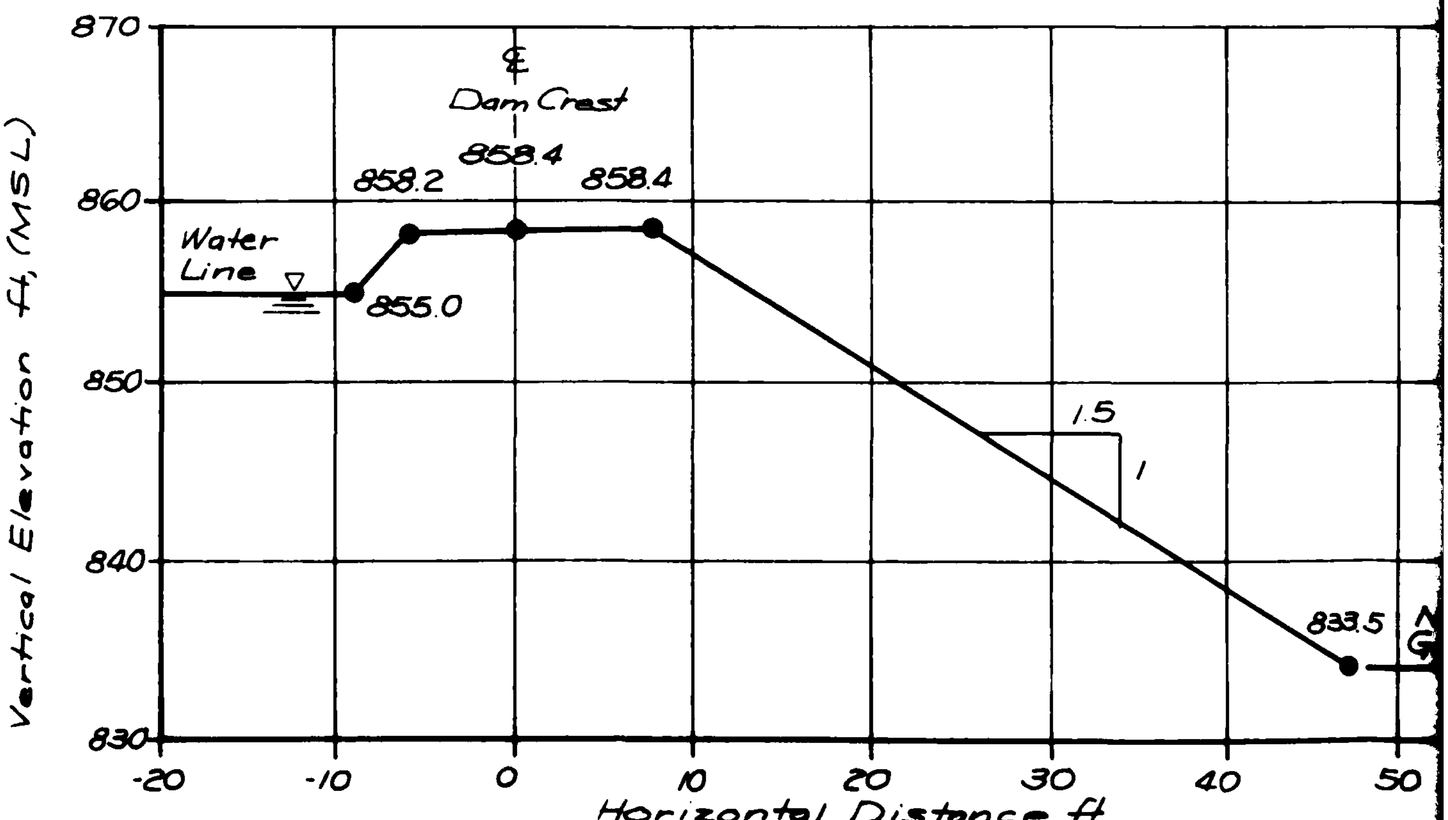


SECTION A-A

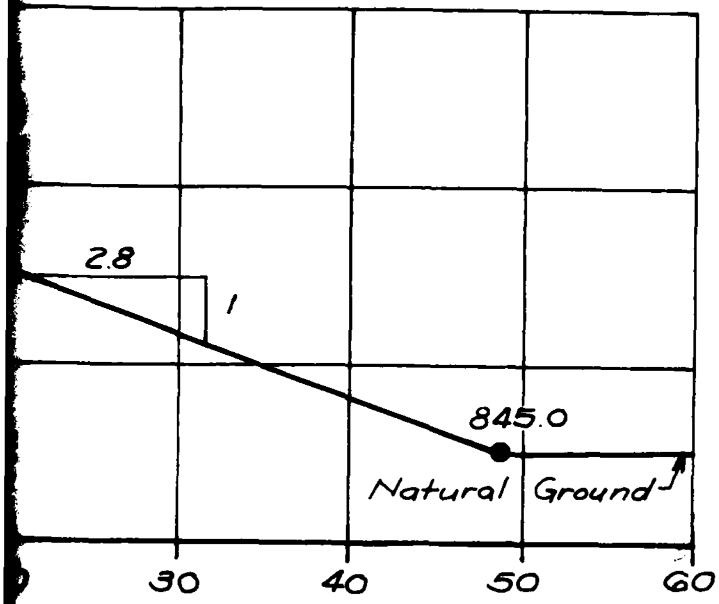
Dam Section

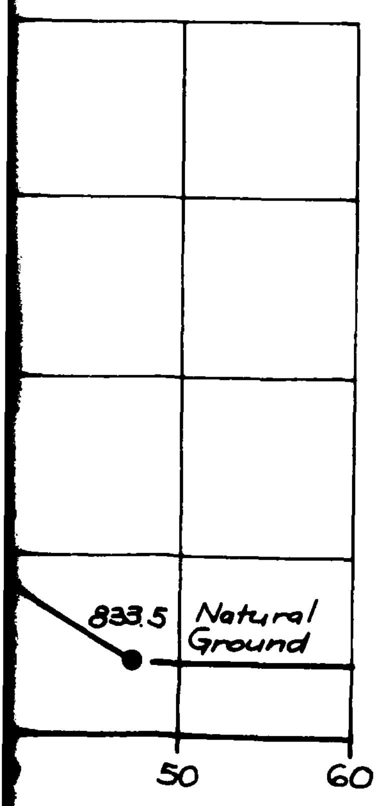


SECTION B-B

Maximum Section

2





NOTE:
Surveyed 17 March 1981 by James F. McCaul III and Associates, Consulting Engineers/Land Surveyors, Potosi, Missouri

DAM SECTIONS	
NEWMAN LAKE DAM	
MO 30488	Fig. 3-B

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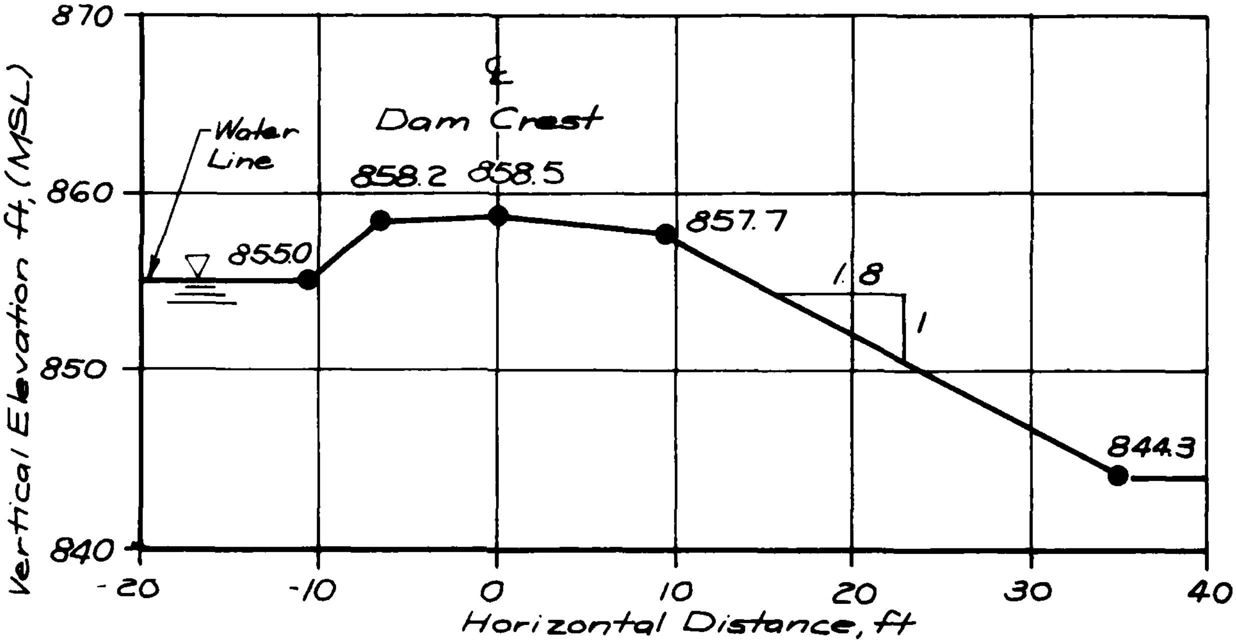
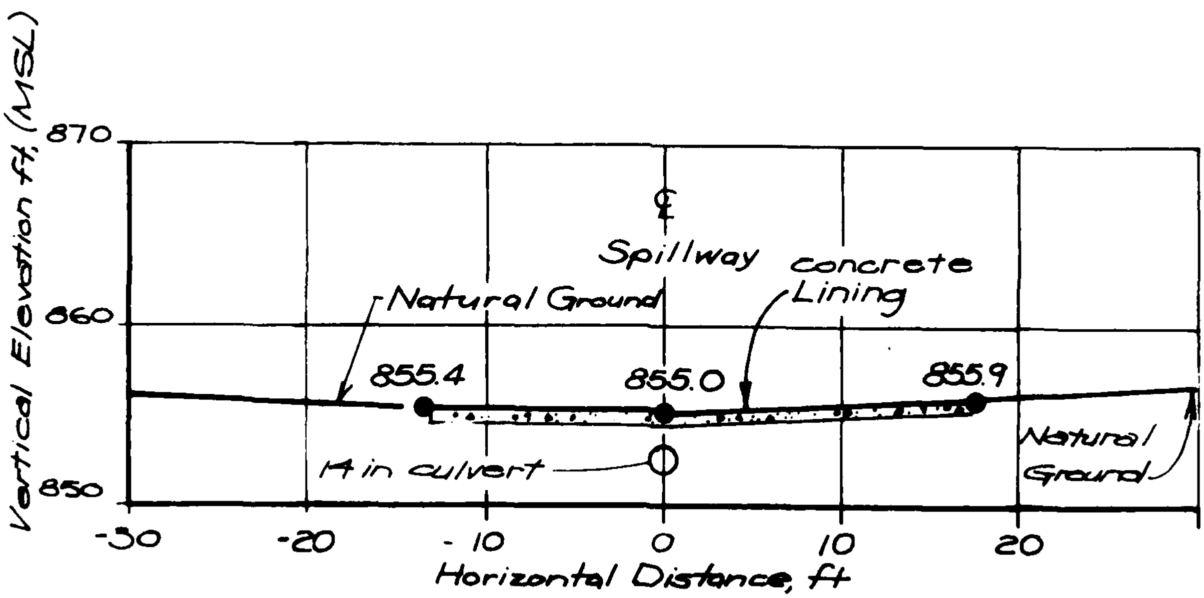


SECTION C-C

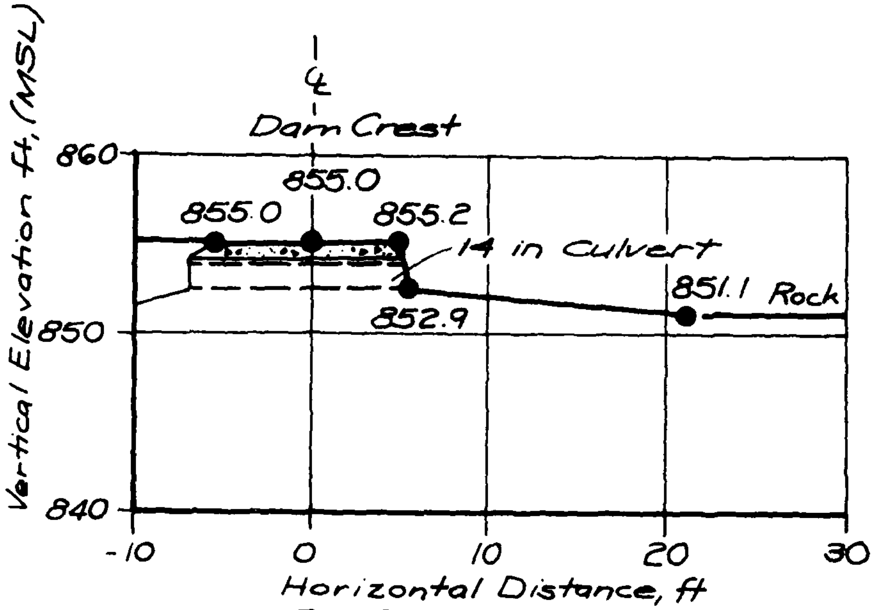
Dam Section



SECTION E-E

Paved Spillway Weir

2

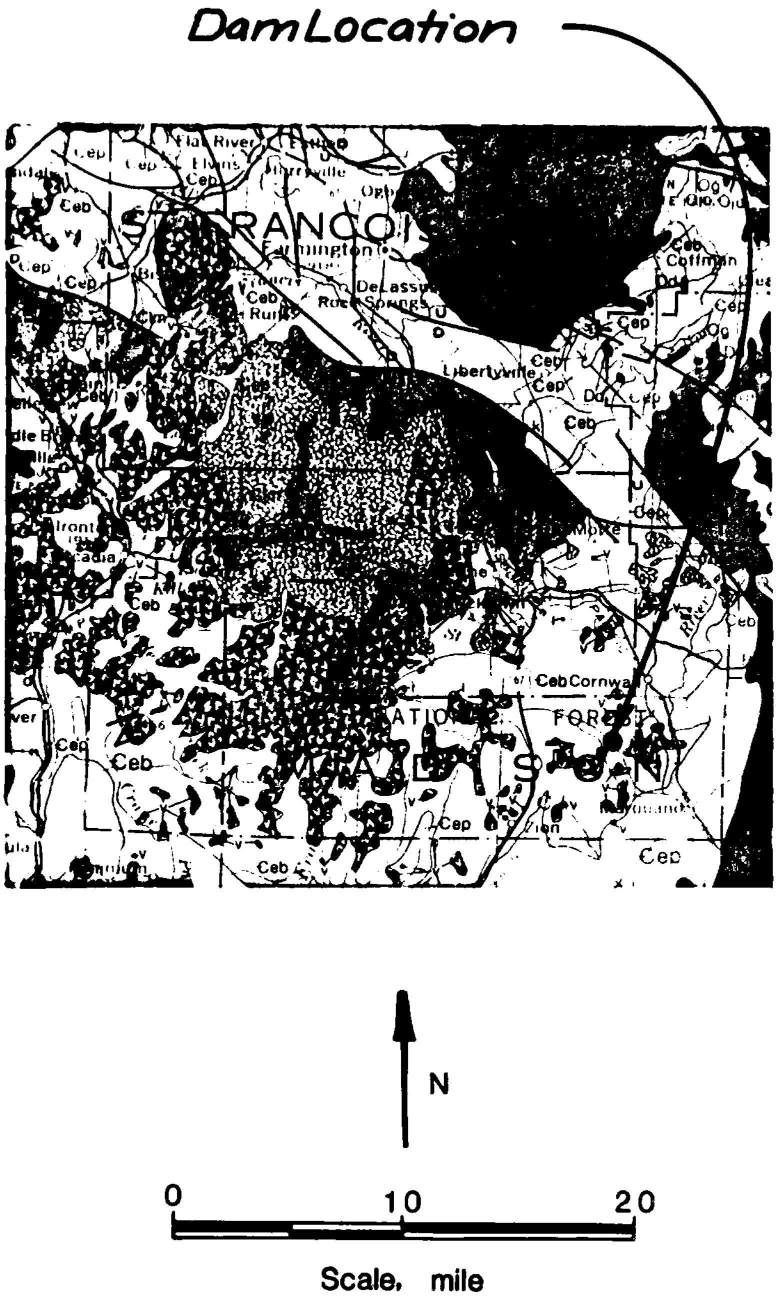


SECTION D-D

Spillway Profile

NOTE:
Surveyed 17 March 1981 by James F. McCaul III and Associates, Consulting Engineers/Land Surveyors, Potosi, Missouri

DAM SPILLWAYS AND DISCHARGE CHANNEL SECTIONS
NEWMAN LAKE DAM
MO 30480 — Fig. [illegible]



Legend

Or	Roubidoux Formation
Og	Gasconade Dolomite Gunter Sandstone Member
Cep	Eminence Dolomite Potosi Dolomite
Ceb	Derby-Doerun Dolomite Davis Formation Bonneterre Formation Whetstone Creek Member Sullivan Siltstone Member
	Reagan Sandstone (subsurface, western Missouri)
	Lamotte Sandstone
	Diabase (dikes and sills)
	St. Francois Mountains Intrusive Suite
	St. Francois Mountains Volcanic Supergroup

REGIONAL GEOLOGIC MAP

NEWMAN LAKE DAM

MO 30488 | Fig.4

APPENDIX A

Photographs

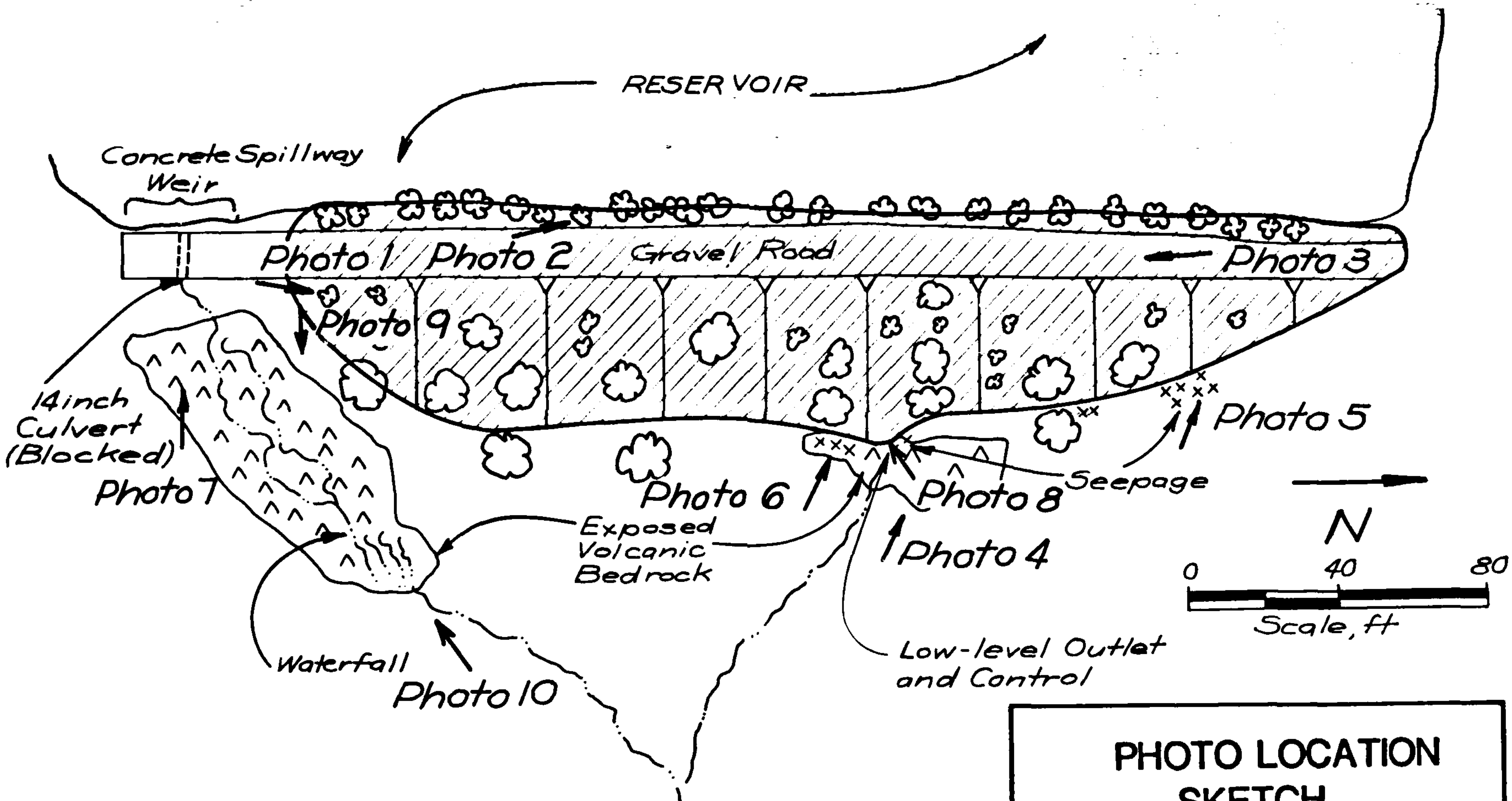


PHOTO LOCATION SKETCH

NEWMAN LAKE DAM

MO 30488	Fig. A - 1

1. Downstream slope of dam. Note steep downstream slope, large trees, stumps, and dense brush growing on dam. Looking north from vicinity of spillway.

2. Wave-cut erosion on upstream slope of dam. Note dense vegetation which provides some erosion protection. Looking north.

3. Gravel road along crest of dam. Water is from precipitation. Spillway is at far end of dam. Looking south.

4. Bedrock outcrops at toe of left abutment. Looking west.

5. Seepage and spongy ground near toe of left abutment.

6. Seepage from bedrock contact with base of embankment at maximum section.

7. Concrete-lined spillway weir at south end of dam. Dam is out of picture to the right. Looking upstream, west, from discharge channel.

8. Low-level outlet and control near toe of maximum section. Flow from pipe estimated at 20 gal/min at time of visual inspection.

9. Rock-lined discharge channel downstream of spillway. Waterfall (Photo 10) starts near middle of photo. Looking northeast.

10. Waterfall in discharge channel. Looking southwest from natural stream channel. Dam is out of picture to the right.

APPENDIX B

Hydraulic/Hydrologic Data and Analyses

APPENDIX B
Hydraulic/Hydrologic Data and Analyses

B.1 Procedures

a. General. The hydraulic/hydrologic analyses were performed using the "HEC-1, Dam Safety Version (1 Apr 80)" computer program. The inflow hydrographs were developed for various precipitation events by applying them to a synthetic unit hydrograph. The inflow hydrographs were subsequently routed through the reservoir and appurtenant structures by the modified Puls reservoir routing option.

b. Precipitation events. The Probable Maximum Precipitation (PMP) and the 1 and 10 percent probability-of-occurrence events were used in the analyses. The total rainfall and corresponding distributions for the 1 and 10 percent probability events were provided by the St. Louis District, Corps of Engineers. The Probable Maximum Precipitation was determined from regional curves prepared by the US Weather Bureau (Hydrometeorological Report Number 33, 1956). The PMP distribution was computed by the HEC-1 program using the standard EM-1110-1411 method.

c. Unit hydrograph. The Soil Conservation Services (SCS) Dimensionless Unit Hydrograph method (SCS, 1971, Hydrology: National Engineering Handbook, Section 4) was used in the analysis. This method was selected because of its simplicity, applicability to drainage areas less than 10 mi^2, and its easy availability within the HEC-1 computer program.

The watershed lag time was computed using the SCS "curve number method" by an empirical relationship as follows:

$$L = \frac{\ell^{0.8}(s+1)^{0.7}}{1900\ Y^{0.5}} \qquad \text{(Equation 15-4)}$$

where: L = lag in hours
ℓ = hydraulic length of the watershed in feet = 7000
$s = \frac{1000}{CN} - 10 = 4.08$

CN = AMC II hydrologic soil curve number as indicated in Section B.2e.
Y = average watershed land slope in percent = 3.4.

This empirical relationship accounts for the soil cover, average watershed slope and hydraulic length.

With the lag time thus computed, another empirical relationship is used to compute the time of concentration as follows:

$$T_c = \frac{L}{0.6} \qquad \text{(Equation 15-3)}$$

where: T_c = time of concentration in hours

L = lag in hours.

Subsequent to the computation of the time of concentration, the unit hydrograph duration was approximated utilizing the following relationship:

$$\Delta D = 0.133T_c \qquad \text{(Equation 16-12)}$$

where: ΔD = duration of unit excess rainfall
T_c = time of concentration in hours.

The final interval was selected to provide at least three discharge ordinates prior to the peak discharge ordinate of the unit hydrograph. For this dam, a unit hydrograph duration of 15 minutes was used.

d. Infiltration losses. The infiltration losses were computed by the HEC-1 computer program internally using the SCS loss function. The curve number of SCS loss rate procedure was established taking into consideration the variables of: (a) antecedent moisture condition, (b) hydrologic soil group classification, (c) vegetative cover and (d) present land usage in the watershed. In addition, the computed basin loss was reduced proportional to the impervious area in the drainage basin.

Antecedent moisture condition III (AMC III) was used for the PMF events and AMC II was used for the 1 and 10 percent probability events, in accordance with the guidelines. The remaining variables are defined in the SCS procedure and judgements in their selection were made on the basis of visual field inspection.

e. Starting elevations. Reservoir starting water surface elevations for this dam were set as follows:

(1) 1 and 10 percent probability events - spillway crest elevation of 855.0 ft.

(2) Probable Maximum Storm - spillway crest elevation of 855.0 ft.

Because the low-level outlet pipe is of small diameter, and the wrench required to operate the valve was not immediately available at the dam, it was assumed the outlet was inoperative and did not pass any amount of the flood.

f. Spillway Rating Curve. The HEC-2 computer program was used to compute the spillway rating curve using the spillway cross section and assuming critical depth over the spillway.

B.2 Pertinent Data

a. Drainage area. 0.86 mi^2

b. Storm duration. A unit hydrograph was developed by the SCS method option of HEC-1 program. The design storm of 48 hours duration was divided into 15-minute intervals in order to develop the inflow hydrograph.

c. Lag time. 1.06 hrs

d. Hydrologic soil group. C

e. SCS curve numbers.

1. For PMF- AMC III - Curve Number 86
2. For 1 and 10 percent probability-of-occurrence events - AMC II - Curve Number 71

f. Storage. Elevation-area data were developed by planimetering areas at various elevation contours on the USGS Marquand (1980) and Cherokee Pass 1980) 7.5-minute quadrangle maps. The data were entered on the $A and $E cards so that the HEC-1 program could compute storage volumes.

g. Outflow over dam crest. As the profile of the dam crest is irregular, flow over the crest was computed according to the "Flow Over Non-Level Dam Crest" supplement to the HEC-1 User's Manual. The crest length-elevation data and hydraulic constants were entered on the $D, $L, and $V cards.

h. Outflow capacity. The spillway rating curve was developed from the cross section data of the spillway using the HEC-2 backwater program. The results of the above were entered on the Y4 and Y5 cards of the HEC-1 program.

i. Reservoir elevations. For the 50 and 100 percent of the PMF events, the starting reservoir elevation was 855.0 ft, the spillway crest elevation. For the 1 and 10 percent probability-of-occurrence events, the starting reservoir elevation was also 855.0 ft, the spillway crest elevation.

B.3 Results

The results of the analyses as well as the input values to the HEC-1 program follow in this Appendix. Only the results summaries are included, not the intermediate output. Complete copies of the HEC-1 output are available in the project files.

Input Data
Various PMF Events
Newman Lake Dam
MO 30488
B4

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************
       1            A1       NEWMAN LAKE, NO. 30488, MADISON COUNTY, MISSOURI.
       2            A2       WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 80C224T100.
       3            A3       PROBABLE MAXIMUM FLOODS.
       4            B     192       0      15       0       0       0       0       0       0       0
       5            B1      5
       6            J       1       2       1
       7            J1    .50    1.00
       8            K       0  INFLOW                                         1
       9            K1       NEWMAN LAKE INFLOW COMPUTATIONS, PMF.
      10            M       1       2   0.859                     1.0
      11            P       0      26     102     120     130     140
      12            T                                                      -1     -86             0.02
      13            W2           1.06
      14            X      -1    -.05       5
      15            K       1     DAM                                         1
      16            K1       FLOOD ROUTING AND OVERTOPPING ANALYSES
      17            Y                               1       1
      18            Y1      1                                          -855.0      -1
      19            Y4   855.   855.8   856.1   856.7   857.8   859.1   861.0   862.4   863.6
      20            Y5     0.    50.0   100.0   200.0   500.0  1000.0  2000.0  3000.0  4000.0
      21            $A     0.     2.7     6.1    10.8     19.
      22            $E   830.    840.    850.    855.    860.
      23            $$ 855.0
      24            $D 858.4     2.8     1.5
      25            $L     0.    31.0   200.0   291.0   312.0
      26            $V 855.9   858.4   858.6   859.1   859.4
      27            K      99
```

```
*********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
 LAST MODIFICATION  01 APR 80
*********************************

RUN  DATE? 81/04/02.
     TIME? 10.35.17.

                    NEWMAN LAKE, NO. 30488, MADISON COUNTY, MISSOURI.
                    WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 80C224T100.
                    PROBABLE MAXIMUM FLOODS.

                                     JOB SPECIFICATION
          NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
         192       0      15       0       0       0       0       0       0       0
                                JOPER     NWT   LROPT   TRACE
                                    5       0       0       0

                              MULTI-PLAN ANALYSES TO BE PERFORMED
                                 NPLAN= 1 NRTIO= 2 LRTIO= 1
          RTIOS=     .50   1.00

   **********     **********     **********     **********     **********

                                 SUB-AREA RUNOFF COMPUTATION

                NEWMAN LAKE INFLOW COMPUTATIONS, PMF.

                           ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                          INFLOW       0       0       0       0       0       1       0       0

                                        HYDROGRAPH DATA
          IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
              1       2     .86    0.00     .86    1.00   0.000       0       0       0

                                          PRECIP DATA
                    SPFE     PMS      R6     R12     R24     R48     R72     R96
                    0.00   26.00  102.00  120.00  130.00  140.00    0.00    0.00

                                          LOSS DATA
          LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
              0    0.00    0.00    1.00    0.00    0.00    1.00   -1.00  -86.00    0.00     .02

            CURVE NO =  -86.00  WETNESS =   -1.00  EFFECT CN =   86.00

                                     UNIT HYDROGRAPH DATA
                                 TC=  0.00     LAG=  1.06

                                         RECESSION DATA
                           STRTQ=    -1.00    QRCSN=     -.05    RTIOR= 5.00

           UNIT HYDROGRAPH 23 END OF PERIOD ORDINATES, TC=    0.00 HOURS, LAG=   1.06  VOL= 1.00
          38.     121.     250.     335.     348.     310.     246.     165.     116.     84.
          60.      42.      30.      21.      15.      11.       8.       5.       4.      3.
           2.       1.       1.

    0                                END-OF-PERIOD FLOW
```

Output Summary
Various PMF Events
Newman Lake Dam
MO 30488
B5

Output Summary
Various PMF Events
Newman Lake Dam
MO 30488
B6

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.15	1	.00	.00	.00	1.	1.02	.15	97	.04	.04	.01	10.
1.01	.30	2	.00	.00	.00	1.	1.02	.30	98	.04	.04	.01	14.
1.01	.45	3	.00	.00	.00	1.	1.02	.45	99	.04	.04	.01	22.
1.01	1.00	4	.00	.00	.00	1.	1.02	1.00	100	.04	.04	.01	33.
1.01	1.15	5	.00	.00	.00	0.	1.02	1.15	101	.04	.04	.01	44.
1.01	1.30	6	.00	.00	.00	0.	1.02	1.30	102	.04	.04	.01	54.
1.01	1.45	7	.00	.00	.00	0.	1.02	1.45	103	.04	.04	.01	62.
1.01	2.00	8	.00	.00	.00	0.	1.02	2.00	104	.04	.04	.01	68.
1.01	2.15	9	.00	.00	.00	0.	1.02	2.15	105	.04	.04	.01	72.
1.01	2.30	10	.00	.00	.00	0.	1.02	2.30	106	.04	.04	.01	75.
1.01	2.45	11	.00	.00	.00	0.	1.02	2.45	107	.04	.04	.01	77.
1.01	3.00	12	.00	.00	.00	0.	1.02	3.00	108	.04	.04	.01	79.
1.01	3.15	13	.00	.00	.00	0.	1.02	3.15	109	.04	.04	.01	80.
1.01	3.30	14	.00	.00	.00	0.	1.02	3.30	110	.04	.04	.01	81.
1.01	3.45	15	.00	.00	.00	0.	1.02	3.45	111	.04	.04	.01	81.
1.01	4.00	16	.00	.00	.00	0.	1.02	4.00	112	.04	.04	.01	82.
1.01	4.15	17	.00	.00	.00	0.	1.02	4.15	113	.04	.04	.01	83.
1.01	4.30	18	.00	.00	.00	0.	1.02	4.30	114	.04	.04	.01	83.
1.01	4.45	19	.00	.00	.00	0.	1.02	4.45	115	.04	.04	.01	83.
1.01	5.00	20	.00	.00	.00	0.	1.02	5.00	116	.04	.04	.00	84.
1.01	5.15	21	.00	.00	.00	0.	1.02	5.15	117	.04	.04	.00	84.
1.01	5.30	22	.00	.00	.00	0.	1.02	5.30	118	.04	.04	.00	84.
1.01	5.45	23	.00	.00	.00	0.	1.02	5.45	119	.04	.04	.00	84.
1.01	6.00	24	.00	.00	.00	0.	1.02	6.00	120	.04	.04	.00	85.
1.01	6.15	25	.02	.00	.01	0.	1.02	6.15	121	.20	.18	.02	90.
1.01	6.30	26	.02	.00	.01	0.	1.02	6.30	122	.20	.18	.02	107.
1.01	6.45	27	.02	.00	.01	0.	1.02	6.45	123	.20	.18	.02	141.
1.01	7.00	28	.02	.00	.01	0.	1.02	7.00	124	.20	.18	.02	189.
1.01	7.15	29	.02	.00	.01	0.	1.02	7.15	125	.20	.18	.01	236.
1.01	7.30	30	.02	.00	.01	0.	1.02	7.30	126	.20	.18	.01	280.
1.01	7.45	31	.02	.00	.01	1.	1.02	7.45	127	.20	.18	.01	315.
1.01	8.00	32	.02	.00	.01	1.	1.02	8.00	128	.20	.18	.01	340.
1.01	8.15	33	.02	.00	.01	1.	1.02	8.15	129	.20	.18	.01	358.
1.01	8.30	34	.02	.00	.01	1.	1.02	8.30	130	.20	.19	.01	371.
1.01	8.45	35	.02	.00	.01	1.	1.02	8.45	131	.20	.18	.01	381.
1.01	9.00	36	.02	.00	.01	1.	1.02	9.00	132	.20	.19	.01	389.
1.01	9.15	37	.02	.00	.01	1.	1.02	9.15	133	.20	.19	.01	394.
1.01	9.30	38	.02	.00	.01	1.	1.02	9.30	134	.20	.19	.01	399.
1.01	9.45	39	.02	.00	.01	1.	1.02	9.45	135	.20	.19	.01	402.
1.01	10.00	40	.02	.00	.01	1.	1.02	10.00	136	.20	.19	.01	405.
1.01	10.15	41	.02	.00	.01	1.	1.02	10.15	137	.20	.19	.01	408.
1.01	10.30	42	.02	.00	.01	1.	1.02	10.30	138	.20	.19	.01	409.
1.01	10.45	43	.02	.00	.01	1.	1.02	10.45	139	.20	.19	.01	411.
1.01	11.00	44	.02	.00	.01	1.	1.02	11.00	140	.20	.19	.01	413.
1.01	11.15	45	.02	.00	.01	1.	1.02	11.15	141	.20	.19	.01	414.
1.01	11.30	46	.02	.00	.01	1.	1.02	11.30	142	.20	.19	.01	415.
1.01	11.45	47	.02	.00	.01	2.	1.02	11.45	143	.20	.19	.01	416.
1.01	12.00	48	.02	.00	.01	2.	1.02	12.00	144	.20	.19	.01	416.
1.01	12.15	49	.05	.01	.04	3.	1.02	12.15	145	.66	.65	.02	435.
1.01	12.30	50	.05	.01	.04	4.	1.02	12.30	146	.66	.65	.02	491.
1.01	12.45	51	.05	.01	.04	7.	1.02	12.45	147	.66	.65	.01	605.
1.01	13.00	52	.05	.02	.04	10.	1.02	13.00	148	.66	.65	.01	759.
1.01	13.15	53	.06	.02	.04	14.	1.02	13.15	149	.80	.78	.01	925.
1.01	13.30	54	.06	.02	.04	19.	1.02	13.30	150	.80	.79	.01	1084.
1.01	13.45	55	.06	.03	.04	25.	1.02	13.45	151	.80	.79	.01	1232.
1.01	14.00	56	.06	.03	.03	31.	1.02	14.00	152	.80	.79	.01	1354.
1.01	14.15	57	.08	.04	.04	37.	1.02	14.15	153	.99	.98	.01	1462.
1.01	14.30	58	.08	.04	.04	44.	1.02	14.30	154	.99	.99	.01	1567.
1.01	14.45	59	.08	.04	.04	51.	1.02	14.45	155	.99	.99	.01	1679.
1.01	15.00	60	.08	.04	.03	59.	1.02	15.00	156	.99	.99	.01	1788.
1.01	15.15	61	.08	.05	.03	67.	1.02	15.15	157	1.01	1.00	.01	1889.

Output Summary
Various PMF Events
Newman Lake Dam
MO 30488
B7

	14.15	57	[illegible]	.04	.04	37.		1.02	14.15	153	[illegible]	[illegible]	.01	[illegible]
	14.30	58	.08	.04	.04	44.		1.02	14.30	154	.99	.99	.01	1567.
1.01	14.45	59	.08	.04	.04	51.		1.02	14.45	155	.99	.99	.01	1679.
1.01	15.00	60	.08	.04	.03	59.		1.02	15.00	156	.99	.99	.01	1788.
1.01	15.15	61	.08	.05	.03	67.		1.02	15.15	157	1.01	1.00	.01	1889.
1.01	15.30	62	.16	.10	.06	76.		1.02	15.30	158	2.02	2.00	.01	2013.
1.01	15.45	63	.43	.30	.13	97.		1.02	15.45	159	5.64	5.62	.02	2342.
1.01	16.00	64	.11	.08	.03	132.		1.02	16.00	160	1.41	1.41	.00	2916.
1.01	16.15	65	.07	.05	.02	177.		1.02	16.15	161	.93	.93	.00	3683.
1.01	16.30	66	.07	.06	.02	209.		1.02	16.30	162	.93	.93	.00	4141.
1.01	16.45	67	.07	.06	.02	218.		1.02	16.45	163	.93	.93	.00	4199.
1.01	17.00	68	.07	.06	.01	210.		1.02	17.00	164	.93	.93	.00	3950.
1.01	17.15	69	.06	.04	.01	192.		1.02	17.15	165	.73	.73	.00	3537.
1.01	17.30	70	.06	.05	.01	169.		1.02	17.30	166	.73	.73	.00	3047.
1.01	17.45	71	.06	.05	.01	152.		1.02	17.45	167	.73	.73	.00	2690.
1.01	18.00	72	.06	.05	.01	140.		1.02	18.00	168	.73	.73	.00	2423.
1.01	18.15	73	.00	.00	.00	128.		1.02	18.15	169	.07	.06	.00	2180.
1.01	18.30	74	.00	.00	.00	114.		1.02	18.30	170	.07	.06	.00	1930.
1.01	18.45	75	.00	.00	.00	98.		1.02	18.45	171	.07	.06	.00	1640.
1.01	19.00	76	.00	.00	.00	80.		1.02	19.00	172	.07	.06	.00	1330.
1.01	19.15	77	.00	.00	.00	63.		1.02	19.15	173	.07	.06	.00	1038.
1.01	19.30	78	.00	.00	.00	48.		1.02	19.30	174	.07	.06	.00	790.
1.01	19.45	79	.00	.00	.00	36.		1.02	19.45	175	.07	.06	.00	595.
1.01	20.00	80	.00	.00	.00	28.		1.02	20.00	176	.07	.06	.00	463.
1.01	20.15	81	.00	.00	.00	23.		1.02	20.15	177	.07	.06	.00	371.
1.01	20.30	82	.00	.00	.00	19.		1.02	20.30	178	.07	.06	.00	309.
1.01	20.45	83	.00	.00	.00	16.		1.02	20.45	179	.07	.06	.00	257.
1.01	21.00	84	.00	.00	.00	14.		1.02	21.00	180	.07	.06	.00	222.
1.01	21.15	85	.00	.00	.00	12.		1.02	21.15	181	.07	.06	.00	196.
1.01	21.30	86	.00	.00	.00	11.		1.02	21.30	182	.07	.06	.00	179.
1.01	21.45	87	.00	.00	.00	11.		1.02	21.45	183	.07	.06	.00	168.
1.01	22.00	88	.00	.00	.00	10.		1.02	22.00	184	.07	.06	.00	160.
1.01	22.15	89	.00	.00	.00	10.		1.02	22.15	185	.07	.06	.00	155.
1.01	22.30	90	.00	.00	.00	10.		1.02	22.30	186	.07	.06	.00	151.
1.01	22.45	91	.00	.00	.00	9.		1.02	22.45	187	.07	.06	.00	148.
1.01	23.00	92	.00	.00	.00	9.		1.02	23.00	188	.07	.06	.00	146.
1.01	23.15	93	.00	.00	.00	9.		1.02	23.15	189	.07	.06	.00	145.
1.01	23.30	94	.00	.00	.00	9.		1.02	23.30	190	.07	.06	.00	144.
1.01	23.45	95	.00	.00	.00	9.		1.02	23.45	191	.07	.06	.00	144.
1.02	0.00	96	.00	.00	.00	9.		1.03	0.00	192	.07	.06	.00	144.
										SUM	36.40	34.55	1.85	75846.
											(925.)(	878.)(	47.)(	2147.72)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4199.	2293.	759.	395.	75775.
CMS	119.	65.	21.	11.	2146.
INCHES		24.83	32.86	34.19	34.19
MM		630.78	834.68	868.46	868.46
AC-FT		1137.	1505.	1566.	1566.
THOUS CU M		1403.	1856.	1931.	1931.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	1.	1.	1.	2.
3.	5.	7.	10.	12.	15.	18.	22.	26.	30.
33.	38.	49.	66.	89.	104.	109.	105.	96.	84.
76.	70.	64.	57.	49.	40.	31.	24.	18.	14.
11.	9.	8.	7.	6.	6.	5.	5.	5.	5.
5.	5.	5.	5.	5.	5.	5.	7.	11.	16.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS: RATIO 1 .50	RATIO 2 1.00
HYDROGRAPH AT	INFLOW	.86	1	2099.	4199.
		(2.22)	(	59.45)(	118.90)(
ROUTED TO	DAM	.86	1	2088.	4196.
		(2.22)	(	59.12)(	118.81)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	855.00	855.00	858.40
STORAGE	94.	94.	139.
OUTFLOW	0.	0.	871.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	859.42	1.02	156.	2088.	3.50	40.75	0.00
1.00	860.38	1.98	175.	4196.	6.00	40.75	0.00

Output Summary
Various PMF Events
Newman Lake Dam
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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .21	RATIO 2 .22	RATIO 3 .23	RATIO 4 .24
				RATIOS APPLIED TO FLOWS			
HYDROGRAPH AT	INFLOW	.86	1	882.	924.	966.	1008.
		(2.22)	(	24.97)(	26.16)(	27.35)(	28.54)(
ROUTED TO	DAM	.86	1	816.	857.	898.	941.
		(2.22)	(	23.12)(	24.27)(	25.42)(	26.65)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	855.00	855.00	858.40
STORAGE	94.	94.	139.
OUTFLOW	0.	0.	871.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.21	858.29	0.00	137.	816.	0.00	41.00	0.00
.22	858.37	0.00	139.	857.	0.00	41.00	0.00
.23	858.45	.05	140.	898.	.50	41.00	0.00
.24	'858.52	.12	141.	941.	.75	41.00	0.00

Output Summary
Various PMF Events
Newman Lake Dam
MO 30488
B9

Input Data
1% Probability Event
Newman Lake Dam
MO 30488

B10

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***********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
 LAST MODIFICATION  01 APR 80
***********************************
  1          A1      NEWMAN LAKE, MO. 30488, MADISON COUNTY, MISSOURI.
  2          A2      WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 80C224T100.
  3          A3      PROBABILISTIC FLOOD - 100 YEAR.
  4          B     192       0      15       0       0       0       0       0       0       0
  5          B1      3
  6          K       0  INFLOW                                      1
  7          K1 RAIN STA. 18-LESTERVILLE, FREQ=  1.0, INTERVAL=15.0 MIN., DURATION= 48 HRS.
  8          M       0       2   0.859                           1.0
  9          O     192   8.838                 DA =    5.00
 10          O1   .016    .016    .016    .016    .016    .016    .016    .016    .016    .016
 11          O1   .016    .016    .016    .016    .016    .016    .016    .016    .016    .016
 12          O1   .016    .016    .016    .016    .016    .016    .016    .016    .016    .016
 13          O1   .016    .016    .016    .016    .016    .016    .016    .016    .016    .016
 14          O1   .016    .016    .016    .016    .016    .016    .016    .016    .016    .016
 15          O1   .016    .016    .016    .016    .016    .016    .016    .016    .016    .016
 16          O1   .016    .016    .016    .016    .016    .016    .016    .016    .016    .016
 17          O1   .016    .016    .016    .016    .016    .016    .016    .016    .016    .016
 18          O1   .016    .016    .016    .016    .016    .016    .016    .016    .016    .016
 19          O1   .016    .016    .016    .016    .016    .016    .021    .021    .021    .021
 20          O1   .021    .021    .021    .021    .021    .021    .021    .021    .021    .021
 21          O1   .021    .021    .021    .021    .021    .021    .021    .021    .021    .021
 22          O1   .041    .041    .041    .041    .042    .042    .042    .042    .042    .042
 23          O1   .042    .042    .042    .042    .042    .042    .042    .042    .042    .042
 24          O1   .042    .041    .041    .041    .075    .076    .076    .076    .076    .076
 25          O1   .102    .102    .178    .180    .424    .769   1.685    .431    .181    .179
 26          O1   .102    .102    .076    .076    .076    .076    .076    .076    .021    .021
 27          O1   .021    .021    .021    .021    .021    .021    .021    .021    .021    .021
 28          O1   .021    .021    .021    .021    .021    .021    .021    .021    .021    .021
 29          O1   .021    .021
 30          T                                                 -1     -71             0.02
 31          W2           1.06
 32          X      -1    -.05       5
 33          K       1     DAM                                  1
 34          K1       FLOOD ROUTING AND OVERTOPPING ANALYSES
 35          Y                               1
 36          Y1      1                                       -855.0      -1
 37          Y4   855.   855.8   856.1   856.7   857.8   859.1   861.0   862.4   863.6
 38          Y5     0.    50.0   100.0   200.0   500.0  1000.0  2000.0  3000.0  4000.0
 39          $A     0.     2.7     6.1    10.8     19.
 40          $E   830.    840.    850.    855.    860.
 41          $$ 855.0
 42          $D 858.4      2.8     1.5
 43          $L     0.    31.0   200.0   291.0   312.0
 44          $V 855.9    858.4   858.6   859.1   859.4
 45          K      99
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********             *****************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************

RUN  DATE? 81/04/02.
     TIME? 10.35.16.


                     NEWMAN LAKE, NO. 30488, MADISON COUNTY, MISSOURI.
                     WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 80C224T100.
                     PROBABILISTIC FLOOD - 100 YEAR.

                                        JOB SPECIFICATION
                NO      NHR     NMIN     IDAY      IHR     IMIN    METRC     IPLT     IPRT    NSTAN
               192        0       15        0        0        0        0        0        0        0
                                        JOPER      NWT    LROPT    TRACE
                                            3        0        0        0

          *********      *********      *********      *********      *********

                                    SUB-AREA RUNOFF COMPUTATION

               RAIN STA. 18=LESTERVILLE, FREQ=  1.0, INTERVAL=15.0 MIN., DURATION= 48 HRS.

                        ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                        INFLOW      0       0       0       0       0       1       0       0

                                         HYDROGRAPH DATA
              IHYDG     IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
                  0        2      .86     0.00      .86     1.00    0.000        0        0        0

                                            PRECIP DATA
                                       NP    STORM      DAJ      DAK
                                      192     8.84     0.00     0.00
                                           PRECIP PATTERN
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .04      .04      .04      .04      .04      .04      .04      .04      .04      .04
           .04      .04      .04      .04      .04      .04      .04      .04      .04      .04
           .04      .04      .04      .04      .08      .08      .08      .08      .08      .08
           .10      .10      .18      .18      .42      .77     1.69      .43      .18      .19
           .10      .10      .08      .08      .08      .08      .08      .08      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
           .02      .02

                                              LOSS DATA
         LROPT    STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTIOK    STRTL    CNSTL    ALSMX    RTIMP
             0     0.00     0.00     1.00     0.00     0.00     1.00    -1.00   -71.00     0.00      .02
```

Output Summary
1% Probability Event
Newman Lake Dam
MO 30488
B11

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-71.00	0.00	.02

CURVE NO = -71.00 WETNESS = -1.00 EFFECT CN = 71.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 1.06

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 5.00

UNIT HYDROGRAPH 23 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= 1.06 VOL= 1.00

38.	121.	250.	335.	348.	310.	246.	165.	116.	84.
60.	42.	30.	21.	15.	11.	8.	5.	4.	3.
2.	1.	1.							

END-OF-PERIOD FLOW

O MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.15	1	.02	.00	.02	1.	1.02	.15	97	.02	.01	.01	9.
1.01	.30	2	.02	.00	.02	1.	1.02	.30	98	.02	.01	.01	10.
1.01	.45	3	.02	.00	.02	1.	1.02	.45	99	.02	.01	.01	10.
1.01	1.00	4	.02	.00	.02	1.	1.02	1.00	100	.02	.01	.01	11.
1.01	1.15	5	.02	.00	.02	1.	1.02	1.15	101	.02	.01	.01	12.
1.01	1.30	6	.02	.00	.02	1.	1.02	1.30	102	.02	.01	.01	12.
1.01	1.45	7	.02	.00	.02	1.	1.02	1.45	103	.02	.01	.01	13.
1.01	2.00	8	.02	.00	.02	1.	1.02	2.00	104	.02	.01	.01	13.
1.01	2.15	9	.02	.00	.02	1.	1.02	2.15	105	.02	.01	.01	14.
1.01	2.30	10	.02	.00	.02	1.	1.02	2.30	106	.02	.01	.01	14.
1.01	2.45	11	.02	.00	.02	1.	1.02	2.45	107	.02	.01	.01	15.
1.01	3.00	12	.02	.00	.02	1.	1.02	3.00	108	.02	.01	.01	15.
1.01	3.15	13	.02	.00	.02	1.	1.02	3.15	109	.02	.01	.01	15.
1.01	3.30	14	.02	.00	.02	1.	1.02	3.30	110	.02	.01	.01	16.
1.01	3.45	15	.02	.00	.02	1.	1.02	3.45	111	.02	.01	.01	16.
1.01	4.00	16	.02	.00	.02	1.	1.02	4.00	112	.02	.01	.01	16.
1.01	4.15	17	.02	.00	.02	1.	1.02	4.15	113	.02	.01	.01	16.
1.01	4.30	18	.02	.00	.02	1.	1.02	4.30	114	.02	.01	.01	17.
1.01	4.45	19	.02	.00	.02	1.	1.02	4.45	115	.02	.01	.01	17.
1.01	5.00	20	.02	.00	.02	1.	1.02	5.00	116	.02	.01	.01	17.
1.01	5.15	21	.02	.00	.02	1.	1.02	5.15	117	.02	.01	.01	17.
1.01	5.30	22	.02	.00	.02	1.	1.02	5.30	118	.02	.01	.01	18.
1.01	5.45	23	.02	.00	.02	1.	1.02	5.45	119	.02	.01	.01	18.
1.01	6.00	24	.02	.00	.02	1.	1.02	6.00	120	.02	.01	.01	18.
1.01	6.15	25	.02	.00	.02	1.	1.02	6.15	121	.04	.02	.02	19.
1.01	6.30	26	.02	.00	.02	1.	1.02	6.30	122	.04	.02	.02	20.
1.01	6.45	27	.02	.00	.02	1.	1.02	6.45	123	.04	.02	.02	22.
1.01	7.00	28	.02	.00	.02	1.	1.02	7.00	124	.04	.02	.02	25.
1.01	7.15	29	.02	.00	.02	1.	1.02	7.15	125	.04	.02	.02	29.
1.01	7.30	30	.02	.00	.02	1.	1.02	7.30	126	.04	.02	.02	32.
1.01	7.45	31	.02	.00	.02	1.	1.02	7.45	127	.04	.02	.02	35.
1.01	8.00	32	.02	.00	.02	1.	1.02	8.00	128	.04	.02	.02	37.
1.01	8.15	33	.02	.00	.02	1.	1.02	8.15	129	.04	.02	.02	39.
1.01	8.30	34	.02	.00	.02	1.	1.02	8.30	130	.04	.02	.02	40.
1.01	8.45	35	.02	.00	.02	1.	1.02	8.45	131	.04	.02	.02	41.
1.01	9.00	36	.02	.00	.02	1.	1.02	9.00	132	.04	.02	.02	43.
1.01	9.15	37	.02	.00	.02	1.	1.02	9.15	133	.04	.02	.02	44.
1.01	9.30	38	.02	.00	.02	1.	1.02	9.30	134	.04	.02	.02	44.
1.01	9.45	39	.02	.00	.02	1.	1.02	9.45	135	.04	.02	.02	45.
1.01	10.00	40	.02	.00	.02	1.	1.02	10.00	136	.04	.02	.02	46.
1.01	10.15	41	.02	.00	.02	1.	1.02	10.15	137	.04	.02	.02	47.
1.01	10.30	42	.02	.00	.02	1.	1.02	10.30	138	.04	.02	.02	48.
1.01	10.45	43	.02	.00	.02	1.	1.02	10.45	139	.04	.02	.02	48.
1.01	11.00	44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Output Summary
1% Probability Event
Newman Lake Dam
MO 30488
B12

Output Summary
1% Probability Event
Newman Lake Dam
MO 30488
B13

	10.45	43	.02	.00	.02	1.	1.02	10.45	139	.04	.02	.02	48.
	11.00	44	.02	.00	.02	1.	1.02	11.00	140	.04	.02	.02	49.
1.01	11.15	45	.02	.00	.02	1.	1.02	11.15	141	.04	.02	.02	49.
1.01	11.30	46	.02	.00	.02	1.	1.02	11.30	142	.04	.02	.02	50.
1.01	11.45	47	.02	.00	.02	1.	1.02	11.45	143	.04	.02	.02	51.
1.01	12.00	48	.02	.00	.02	1.	1.02	12.00	144	.04	.02	.02	51.
1.01	12.15	49	.02	.00	.02	1.	1.02	12.15	145	.07	.04	.03	52.
1.01	12.30	50	.02	.00	.02	1.	1.02	12.30	146	.08	.05	.03	55.
1.01	12.45	51	.02	.00	.02	1.	1.02	12.45	147	.08	.05	.03	60.
1.01	13.00	52	.02	.00	.02	1.	1.02	13.00	148	.08	.05	.03	68.
1.01	13.15	53	.02	.00	.02	1.	1.02	13.15	149	.08	.05	.03	76.
1.01	13.30	54	.02	.00	.02	1.	1.02	13.30	150	.08	.05	.03	83.
1.01	13.45	55	.02	.00	.02	1.	1.02	13.45	151	.10	.07	.04	90.
1.01	14.00	56	.02	.00	.02	1.	1.02	14.00	152	.10	.07	.03	97.
1.01	14.15	57	.02	.00	.01	1.	1.02	14.15	153	.18	.12	.06	107.
1.01	14.30	58	.02	.00	.01	1.	1.02	14.30	154	.18	.12	.06	122.
1.01	14.45	59	.02	.00	.01	1.	1.02	14.45	155	.42	.30	.12	150.
1.01	15.00	60	.02	.00	.01	2.	1.02	15.00	156	.76	.57	.19	208.
1.01	15.15	61	.02	.00	.01	2.	1.02	15.15	157	1.67	1.36	.32	340.
1.01	15.30	62	.02	.00	.01	2.	1.02	15.30	158	.43	.36	.07	546.
1.01	15.45	63	.02	.00	.01	2.	1.02	15.45	159	.18	.15	.03	784.
1.01	16.00	64	.02	.00	.01	3.	1.02	16.00	160	.18	.15	.02	935.
1.01	16.15	65	.02	.00	.01	3.	1.02	16.15	161	.10	.09	.01	956.
1.01	16.30	66	.02	.00	.01	3.	1.02	16.30	162	.10	.09	.01	877.
1.01	16.45	67	.02	.00	.01	3.	1.02	16.45	163	.08	.07	.01	742.
1.01	17.00	68	.02	.00	.01	3.	1.02	17.00	164	.08	.07	.01	587.
1.01	17.15	69	.02	.00	.01	4.	1.02	17.15	165	.08	.07	.01	469.
1.01	17.30	70	.02	.00	.01	4.	1.02	17.30	166	.08	.07	.01	382.
1.01	17.45	71	.02	.00	.01	4.	1.02	17.45	167	.08	.07	.01	315.
1.01	18.00	72	.02	.00	.01	4.	1.02	18.00	168	.08	.07	.01	266.
1.01	18.15	73	.02	.00	.01	5.	1.02	18.15	169	.02	.02	.00	230.
1.01	18.30	74	.02	.00	.01	5.	1.02	18.30	170	.02	.02	.00	199.
1.01	18.45	75	.02	.00	.01	5.	1.02	18.45	171	.02	.02	.00	170.
1.01	19.00	76	.02	.00	.01	5.	1.02	19.00	172	.02	.02	.00	141.
1.01	19.15	77	.02	.00	.01	6.	1.02	19.15	173	.02	.02	.00	116.
1.01	19.30	78	.02	.00	.01	6.	1.02	19.30	174	.02	.02	.00	95.
1.01	19.45	79	.02	.00	.01	6.	1.02	19.45	175	.02	.02	.00	79.
1.01	20.00	80	.02	.00	.01	6.	1.02	20.00	176	.02	.02	.00	68.
1.01	20.15	81	.02	.00	.01	6.	1.02	20.15	177	.02	.02	.00	60.
1.01	20.30	82	.02	.00	.01	7.	1.02	20.30	178	.02	.02	.00	54.
1.01	20.45	83	.02	.00	.01	7.	1.02	20.45	179	.02	.02	.00	49.
1.01	21.00	84	.02	.00	.01	7.	1.02	21.00	180	.02	.02	.00	46.
1.01	21.15	85	.02	.00	.01	7.	1.02	21.15	181	.02	.02	.00	44.
1.01	21.30	86	.02	.00	.01	7.	1.02	21.30	182	.02	.02	.00	43.
1.01	21.45	87	.02	.00	.01	8.	1.02	21.45	183	.02	.02	.00	42.
1.01	22.00	88	.02	.00	.01	8.	1.02	22.00	184	.02	.02	.00	42.
1.01	22.15	89	.02	.00	.01	8.	1.02	22.15	185	.02	.02	.00	42.
1.01	22.30	90	.02	.00	.01	8.	1.02	22.30	186	.02	.02	.00	41.
1.01	22.45	91	.02	.00	.01	8.	1.02	22.45	187	.02	.02	.00	41.
1.01	23.00	92	.02	.00	.01	8.	1.02	23.00	188	.02	.02	.00	41.
1.01	23.15	93	.02	.00	.01	9.	1.02	23.15	189	.02	.02	.00	41.
1.01	23.30	94	.02	.00	.01	9.	1.02	23.30	190	.02	.02	.00	41.
1.01	23.45	95	.02	.00	.01	9.	1.02	23.45	191	.02	.02	.00	41.
1.02	0.00	96	.02	.00	.01	9.	1.03	0.00	192	.02	.02	.00	41.
									SUM	8.84	5.39	3.45	11744.
										(224.)(	137.)(	88.)(	332.95)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	956.	372.	119.	61.	11708.
CMS	27.	11.	3.	2.	332.
INCHES		4.02	5.17	5.28	5.28
MM		102.21	131.36	134.19	134.19
AC-FT		184.	237.	242.	242.
THOUS CU M		227.	292.	298.	298.

RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES(SQUARE KILOMETERS)

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	INFLOW	956.	372.	119.	61.	.86
		(27.08)(	10.52)(	3.38)(	1.73)(	2.22)
ROUTED TO	DAM	841.	365.	116.	59.	.86
		(23.81)(	10.34)(	3.28)(	1.67)(	2.22)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	855.00	855.00	858.40
STORAGE	94.	94.	139.
OUTFLOW	0.	0.	871.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	858.34	0.00	138.	841.	0.00	40.50	0.00

Output Summary
1% Probability Event
Newman Lake Dam
MO 30488
B14